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Construction Methods

McGraw-Hill Publishing Company, Inc.

August, 1934

POURING FIRST CONCRETE on Colorado River Aqueduct in California at East Mill siphon. Steel reinforcement and movable steel forms are in place for 12-ft. 4 *in.* diameter conduit. Work is being done by Metropolitan Water District of Southern California to determine relative merits of monolithic and precast concrete siphon.

If it's a question of

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Construction Methods

McGraw-Hill Publishing Company, Inc.,
330 West 42nd St., New York

ROBERT K. TOMLIN, Editor

AUGUST 1934

WILLARD CHEVALIER, Vice-President

Editorial Staff: Vincent B. Smith, N. A. Bowers (San Francisco)
Leonard H. Church (Cleveland), Nelle Fitzgerald

Seven More Code Explanations

● Seven more "explanations" of code provisions, supplementing the twenty interpretations previously reported on this page, have been issued by the Construction Code Authority as follows:

21—Owner Shopping for Bids

● Even though a reduction in price may be made through bid shopping on the part of the awarding authority, the bidder is not permitted to accept such price, and becomes party to a violation of the code if the award is made at less than the bidder's original bid price.

22—Maintenance Work

● In regard to maintenance work in industrial plants, each divisional chapter must be examined to determine whether maintenance work is covered. So far as Chapter I is concerned the definition includes only the modification of building structures or of fixed structures and other fixed improvements. Coverage of the several divisional chapters varies with respect to maintenance work. The general contractors' chapter covers not only modification of structures but also repairs thereto. The definitions in certain other chapters of the code cover the contracting for particular work described, and where maintenance and repair is specifically included, it would be covered by the code when performed by a member of the division.

23—Construction by Industrial Firms

● All construction work performed by industrial companies must be performed in accordance with the provisions of the code, including Chapter I, and provisions of the various divisional chapters. When such construction work is performed by day labor method under the direct supervision of the company, the individual company, or a wholly owned construction subsidiary becomes a member of the industry and is subject to the code.

24—Definition of Subcontractor

● Question has been raised regarding the status of vendors who supply materials specifically required for a particularly project, being designed or fabricated under specifications for the project in regard to classification as subcontractor and therefore subject to the bidding practices mentioned in the code. Section 1 (a) of Article VII, Chapter I, defines competitive bidding as the submission of comparable proposals by two or more invited persons to execute a specific program of work, furnish a definite service or supply materials specifically required for a particular project at a stipulated price. Obviously, the term "subcontractor" as used in Section 7, Chapter I, includes those furnishing materials only when competitive bids are asked for according to the code, and such bids must be submitted by the subcontractor not less than 24 hours prior to the time set for receipt of the bid of the contractor by the awarding authority. Where competitive bidding is not used, the code does not specify the requirements as to when prices shall be submitted to the contractor. Explanation 24 should be considered in conjunction with Explanation 9 (See *Construction Methods*, July, 1934)

The Road Hog

Talburt, in the New York World Telegram

25—Application of Chapter I.

● Chapter I applies to all members of the industry, irrespective of divisional affiliations. Chapter I was drafted as a complete framework, covering all functions of the industry included in its definition, and additional chapters only supplement this framework by providing special regulations for different branches of the industry. It is a complete code document, covering hours, wages, conditions of employment, code administration and competitive bidding practices, all of which are binding upon the members of a division of the industry who are under an additional chapter (except as provisions of the additional chapter conflict therewith) and provide the only code regulations for other members of the industry whose specific functions have not been defined in an additional chapter approved by the President.

26—Filing of Estimates by General Contractors

● Special contracting groups have raised the question as to whether a general contractor should file copies of his estimate with the bid depositories either when he does not ask for bids from subcontractors but intends to perform the work himself, or when he does ask for bids from subcontractors but puts in his own figure when making up the bid to the awarding authority. In the first instance, competitive bidding is not involved, and hence the code regulations regarding bid depositories would be inoperative. In the second instance, although competitive bidding is entered into, the purpose of bid depository systems is to provide a method of checking the award, if made from bids submitted, against the bidder's original bid price, as a protection principally to all bidders. In this transaction, the general contractor occupies the position of an awarding authority if he obtains the job, and he cannot occupy the dual position of awarding authority and bidder. Accordingly, he would not be required to file a copy of his estimate of the work in question as a duplicate bid.

27—Divisional Inter-Relations

● Administration of each chapter of the code is expressly delegated to the divisional code authority established under such additional chapter. Under the functional definitions of Chapter I, a member of the industry is defined as one engaged in any phase or undertaking to perform any of the functions of the industry; while member of the division is defined as any member undertaking to perform any functions of a division of the industry as defined in the provisions of the chapter applicable especially to such division. Accordingly, such member of the industry would be subject to the code administration of the divisional code authority established thereunder, including payment of approved assessment thereunder for code administrative expense, regardless of whether such member of the industry performs all of his work or services under that particular chapter, or only occasionally operates thereunder. This explanation does not conflict with the Administrator's order of April 14 which provides that a firm is required to pay an assessment for code administration only to the Code Authority governing its principal line of business, because the Construction Code is, in effect, only one code, and subdividing of assessments for administrative expense is a matter of internal organization. However, it implies that a general contractor will be subject to the approved assessments for work performed by his own forces under various other divisional chapters and places the same assessment on such work whether performed by his own workmen or through subcontractors.

The House *at the Crossroads*

NOT LONG AGO a great industrial company announced that during one year it had paid to certain of its employees the sum of $94,000 in bonuses to reward them for suggesting better operating methods in its plants. This covered some 9600 suggestions, making the average compensation for each idea nearly ten dollars.

This deflates the present writer somewhat when he reflects that the annual price of *Construction Methods*, which offers in the course of a year hundreds of valuable ideas gleaned from scores of construction jobs, is no more than two dollars. And his discomfort is not relieved by the further reflection that some alert reader might possibly have cribbed just one of those bargain-price ideas from this journal and sold it to his boss for a ten-spot! But if he did, more power to him; he would not be the first to reap a profit by buying at the bottom and selling at the top.

A genuine industrial journal, one that lives *for* its industry rather than *off* it, one that is edited consistently in the interest of its readers, must primarily be a source of useful ideas and information. It is a clearing-house set up at the crossroads of its industry where it can intercept and direct the flow of thought and knowledge from every quarter.

Operating ideas are the life-blood of any industry. The richness and strength of that blood-stream will determine the health and vigor of the industry. Or, to change the figure, ideas are the currency of progress; they are of value to an industry only as they are circulated and kept at work rather than hoarded. The maintenance of this circulation, the constant gathering and redistribution of data and ideas that are new, valuable or helpful is one of the most vital processes of every business. It is to industry what the intelligence service is to an army.

Every day, on the drawing board of the engineer, in the field with the contractor and in the plant of the materials or equipment manufacturer, new ideas are born. Eventually they may be worth much to the industry or they may be worth little, dependent on the extent to which they may be broadcast, i.e., the rate at which they may be circulated.

The reading and advertising pages of this journal seek to provide such a clearing-house at the crossroads of the construction industry. To it come regularly a host of construction men — engineers, contractors, manufacturers — all, in short, who are responsible for the practical conduct of construction operations. They come to learn what others are doing, how they are doing it and what is available in the way of materials and equipment.

In these times there is more than the normal need for this indispensable service. If jobs are to be taken, bids must be figured closely. In several recent cases the use of novel methods and plant has been the decisive factor both in getting the job and making it pay. Wise employers encourage their staffs to follow closely the reputable journals of their industries. They want their men to stand in the stream of progress, exposed to ideas that will make them more productive for themselves as well as for their organization.

Frequently this journal welcomes from some reader a word of acknowledgment for a profitable idea gleaned from its pages. Each of these is a gratifying reassurance that *Construction Methods* actually is on the job speeding up that traffic in ideas which measures the progress of its industry.

Willard Chevalier

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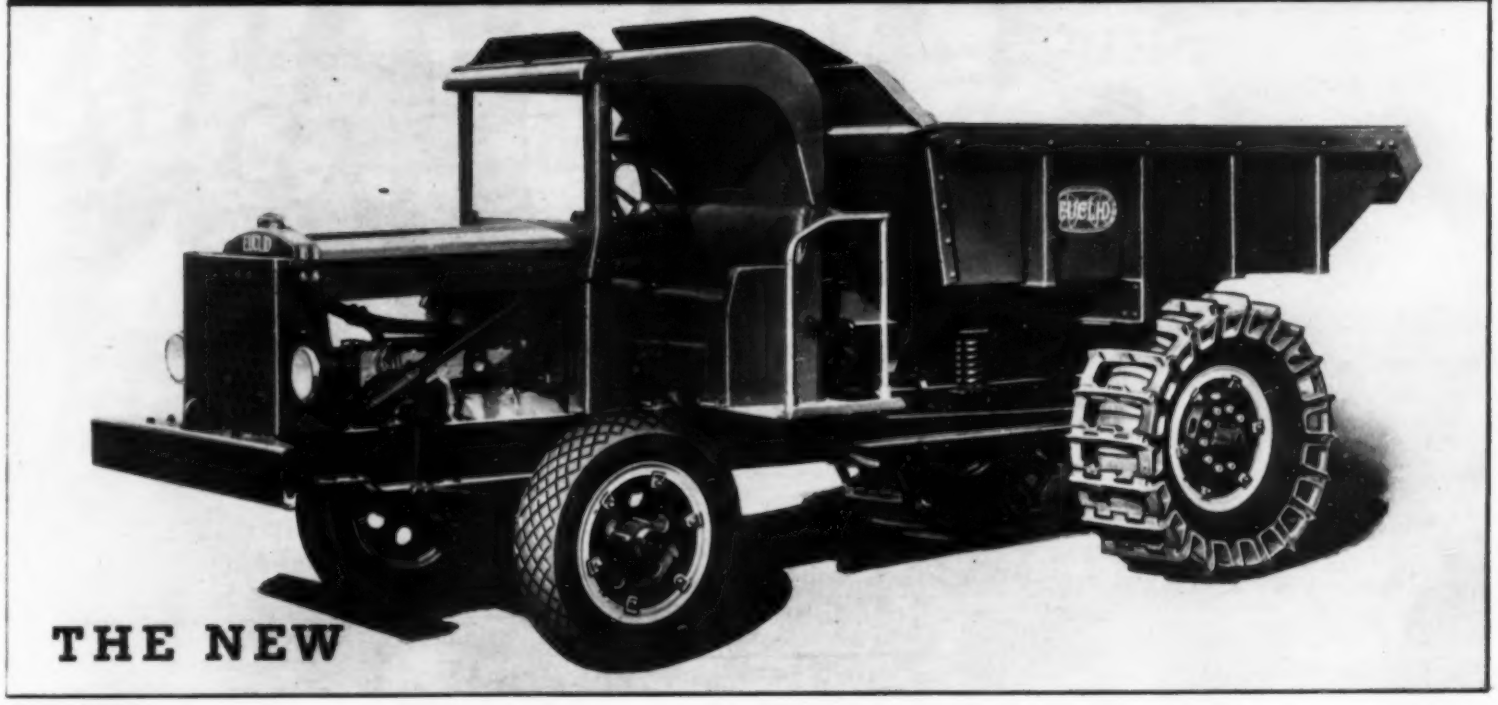
Another EUCLID PIONEER



THE NEW

Rear Dump TRAC-TRUK

Again Euclid is first and foremost in originating and perfecting material handling equipment incorporating advanced engineering features entirely new to the industry. For the first time, all the advantages of full crawler construction are made available at a speed that is practical and economical for faster and medium long distance haulage. And still an additional feature is found in the fact that the *tire tracks*—by which this combination of speed and traction is accomplished—may be installed quickly or removed readily for operation with either single or dual pneumatics. Thus is provided a range of working speeds and selective traction equipment to meet every *job* or *ground* condition to a degree heretofore unknown.

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Ruggedness—frame, body, housings, in fact every structural unit throughout is reinforced and built to withstand the rocks and shocks of heavy material handling.

Power—equipped with a 100 H. P. engine delivering ample power for heavy pulls, peak loads and to utilize fully the extra ground-gripping traction of tire tracks.

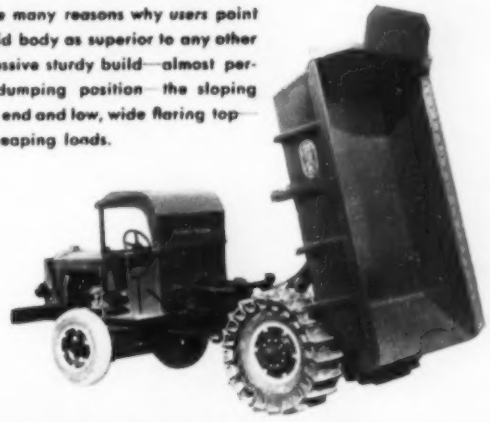
Speed—a range and ratio that balances the essentials for moving big loads over rough surfaces with *all* operating requirements, resulting in unmatched overall speed economy.

Traction—ample and positive traction for every kind of footing with the feature of quick change to tire tracks, single or dual pneumatics.

Short Turning—an exceptionally short wheel base supplemented with separate foot operated steering brakes, saving time on every trip and turn.

Body Design—A sturdily constructed body—without troublesome hinged end-gate—and hoisting to a near vertical dumping angle, which eliminates banging and jerking back and forth to deposit the load.

A few of the many reasons why users point out the Euclid body as superior to any other are—the massive sturdy build—almost perpendicular dumping position—the sloping built-in rear end and low, wide flaring top—permitting heaping loads.



Out in the rough, rocky country (where good roads have never been) standards of performance are determined *in advance*. Euclids measure up to these extreme requirements naturally, due to a thorough study of field conditions. Knowledge of exacting operators' needs *before hand*, is responsible for the strength, dependability and endurance built into Trac Truk design.

You will want to see the full specifications of this new Euclid. Write and ask for Bulletin TRT-RD

THE EUCLID ROAD MACHINERY CO.
CLEVELAND OHIO

Over 6000 YARDS a day with a LIMA TYPE 701

1 3-4 YD. SHOVEL

Over 6000 yards of material a day is the record made by the LIMA 701, 1¾ yard shovel owned by Goodfellow Brothers, Inc., Wenatchee, Wash., on the Grand Coulee Dam job.

The type 701 is working three shifts a day, or approximately 21 hours actual operating time. During this period it has been loading overburden into 8-yard dump trucks at the rate of 300 to 360 yards per hour. The remarkable stamina, power and speed of the Type 701 cannot be denied. Yardage records are being smashed wherever the Type 701 is used.

Comparisons prove that the Type 701 with its many advanced engineering principles and its exceptionally low upkeep is giving the user of excavating machinery new low figures in material handling cost.

For further information regarding LIMA excavators write to the Home Office, or to the branch office nearest you.

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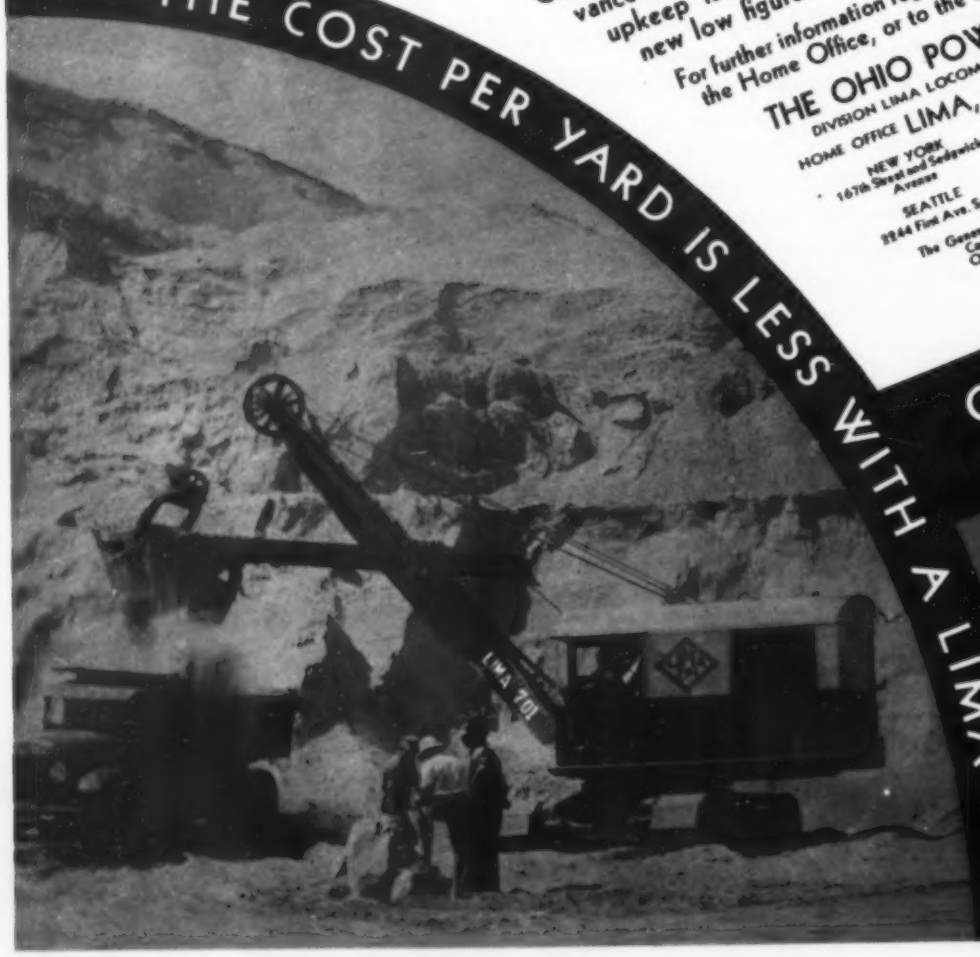

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A Type and Size for Every Job

CAPACITIES

Shovels - - - - ¾ yd. to 9 yd.

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'INCOR' Makes Better Concrete

by Curing Thoroughly in Limited Time Available on Average Job

1 Swimming pools require dense, watertight concrete. Engineers specified 'Incor' without admixtures for this Stamford, Conn., Yacht Club pool. Job was watertight, ready to use, 24 hours after last concrete was poured.

Service Strength
IN 24 HOURS

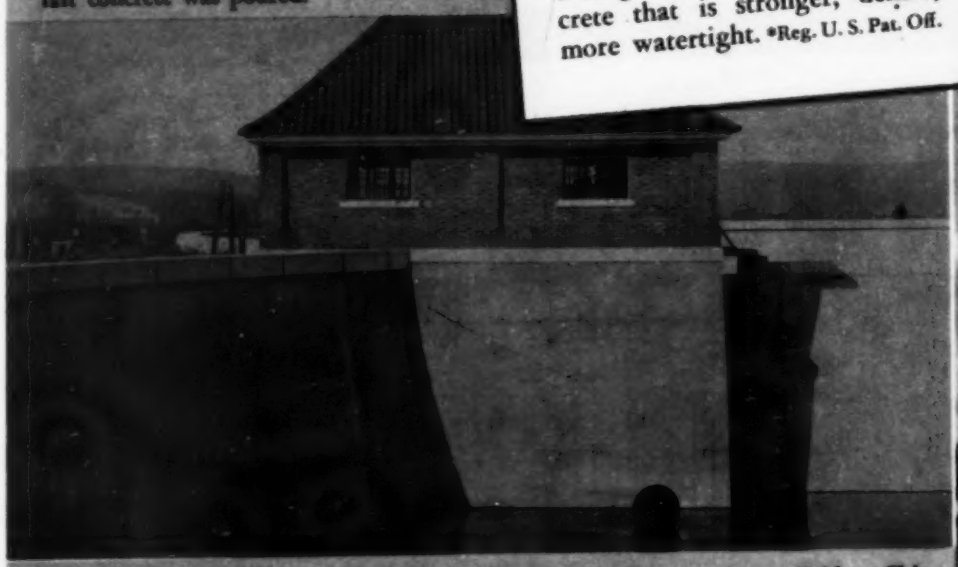
Watertight
IN 48 HOURS

CURING, that is, keeping concrete wet, cannot go on indefinitely; it costs money, interferes with use of the structure. The best concrete is that which cures thoroughly in the short time it is kept wet.

'Incor' 24-Hour Cement 'cures' or combines with water 5 times as fast as ordinary, single-burned cement. That is why 'Incor' is service strong in 24 hours—watertight in 48 hours.

By curing thoroughly in the limited time available on the average job, 'Incor'* makes concrete that is stronger, denser, more watertight. *Reg. U. S. Pat. Off.

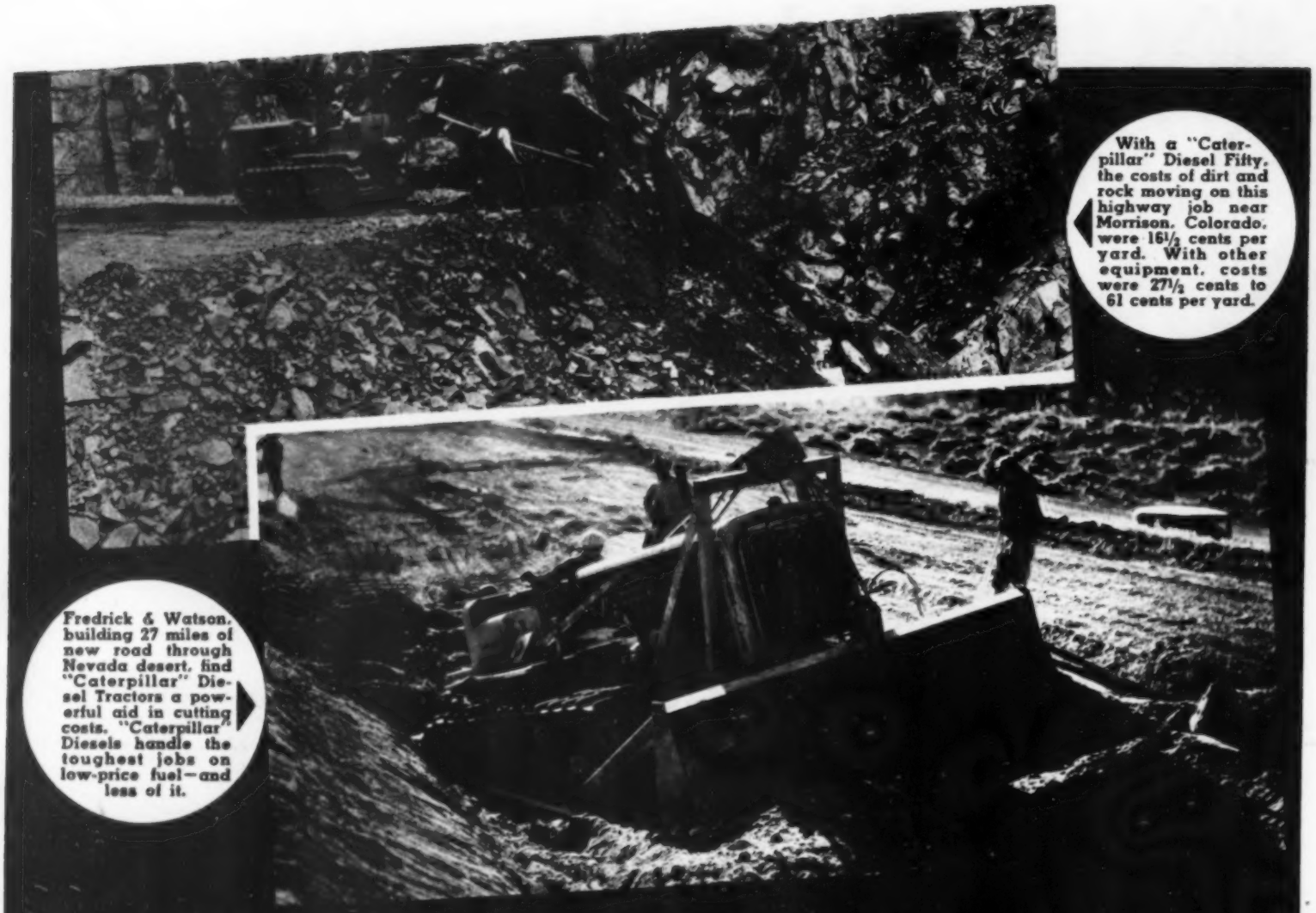
2 Built in mid-winter with 'Incor' cement, these settling tanks for Cretona Print & Dye Works, Clifton, N. J., are giving thoroughly watertight service. Concrete heated to 60° produced 24-hour strengths equal to 7 days with ordinary cement.



3 Mill Rock Reservoir, New Haven, Conn., Water Co.; constructed of 'Incor' concrete, without surface treatment or waterproofing compound. Completed in summer, 1931, it hasn't leaked a thimbleful.

4 *(Right)* Wabash Avenue Bridge, Chicago; 'Incor' was used in precast slabs for sidewalk and roadway. Dense, watertight concrete has successfully prevented moisture absorption, assuring continuous balance between bascule leaves and counterweight.

'INCOR' 24-Hour Cement



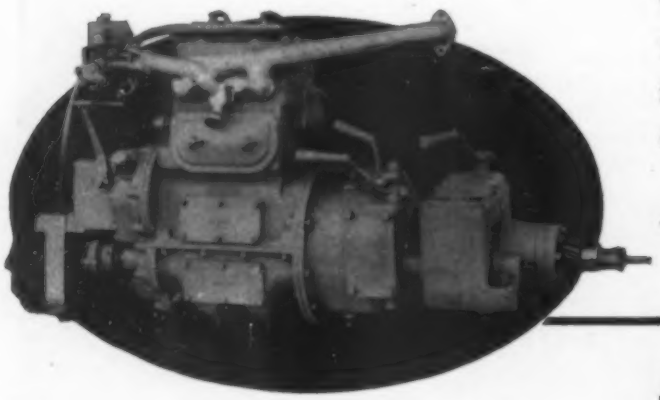
With a "Caterpillar" Diesel Fifty, the costs of dirt and rock moving on this highway job near Morrison, Colorado, were 16⅓ cents per yard. With other equipment, costs were 27⅓ cents to 61 cents per yard.

Fredrick & Watson, building 27 miles of new road through Nevada desert, find "Caterpillar" Diesel Tractors a powerful aid in cutting costs. "Caterpillar" Diesels handle the toughest jobs on low-price fuel—and less of it.

"THE 'CATERPILLAR' DIESEL IS THE GREATEST ENGINE I'VE EVER SEEN"

●● says J. H. Argerter, who operates the Moniteau County, Missouri, "Caterpillar" Diesel Tractor. He adds: "I have worked with many engines since 1920 and this Diesel tractor is beyond a doubt the best of all."

"No expense, no delay"—"Fuel costs below our expectations or even hopes"—"Not a minute's time lost"—"Lots of power, and the smoothest we've ever known"—"Simpler than a gas tractor, and better in every way." . . . Those are typical expressions from "Caterpillar" Diesel owners. Some of them bought on confidence in "Caterpillar" superiority—some on study of "Caterpillar" design and construction—now they have the proof of performance. Study the "Caterpillar" Diesel, or talk to users—either way you'll come to the conclusion that the "Caterpillar" Diesel is the surest, safest investment in power equipment. Caterpillar Tractor Co., Peoria, Illinois, U. S. A.



◀ Mr. R. G. Warren, Supervisor, of Hampton, N. Y., says: "The starting system can't be beat—this system (gasoline starting engine) does away with costly up-keep of batteries and is always a sure starter."

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"AMERICAN" Hoisting Equipment has always given industry the best in engineering, design and construction. East and West, North and South, "AMERICAN" Hoisting Equipment is talked about for its dependable quality, its many design and performance contributions and its long time successful record. It is great to have this reputation for progressive engineering and quality. We doff our hats again in just acknowledgment of this tribute.

Though we do enjoy this quality distinction, we want price to enter into the picture correctly and make it scream for attention so that you will know that with all its high quality "AMERICAN" Hoisting Equipment is within today's low price range.

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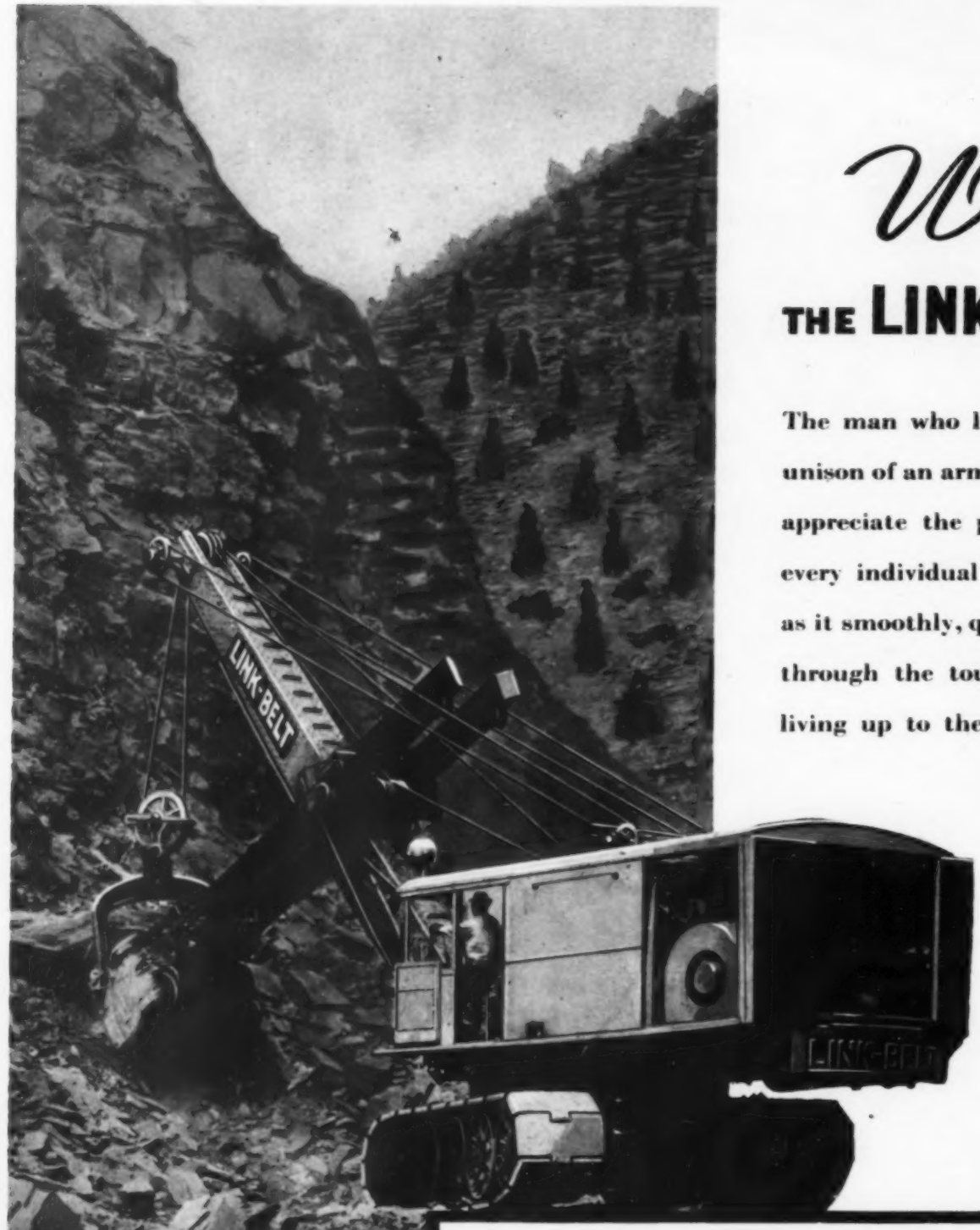

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SPREADS, SCREEDS and VIBRATES Stone, Gravel, Slurry, Macadam and All Bituminous Mixes; Does a Faster, Cleaner Job; CUTS COSTS, and Produces a SMOOTHER RIDING SURFACE . . . . . .

- Spreads leveling, binder and top courses, any thickness 1" to 8", is adjustable by means of telescoping frame for any width from 9' to 14'.
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Sinclair's Navy Work-Factor Tests of oils prove that many industries may waste money by having too many lubricants. Sinclair recommendations, based on work-factor, have reduced lubricating inventory and lowered operating costs in major industries. Here are examples:

A leather manufacturing concern, whose 21 plants formerly required 50 different oils and greases now uses only 20 Sinclair lubricants—with a saving of 47.6% in cost of lubrication . . . A leading paper company cut its lubricating costs 25% with Sinclair Oils . . . One of the country's largest makers of heating equipment showed a saving of 37.7% with Sinclair Oils . . . Sinclair engineers have proved that only 10 lubricants are needed for all cotton and woolen textile machinery — a reduction of better than 50%.

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...ow the CUSHION CLUTCH reduces wear and tear in Tough Digging?
WHAT happens on your machine when the dipper, backed by the full power of the engine, crashes into an immovable rock? Something strains! Something gives! Perhaps something breaks!
In any case, here is shock that means wear and tear and reduced machine life.
The Northwest Cushion Clutch is an exclusive feature that increases the life of your Northwest. It transmits the full engine power, but reduces the maximum stresses on every part under power when the hoist rope is tensioned to the point of overload. It gives the operator more time to throw out the clutch and prevent engine stalling. It smooths out jolts and jars and reduces drum clutch adjustment. It lengthens hoist rope life—in short, it combines the great digging power of the Northwest Shovel with the cushion of steam.
And remember that the Cushion Clutch is only one of the many advantages that Northwest has to offer you.
Get the truth about shovel output. Let us tell you what Northwests are doing.
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PROSPERITY DEMANDS *that the* BOSS *make money, too*

For good business, nothing will ever take the place of sharp pencils—backed up by clear thinking. And close figuring is very necessary these days.

Quarry men and contractors are finding it good business to use Cordeau-Bickford, the *insensitive* detonating agent. For in any but the most simple blasting, the savings effected by the use of Cordeau far offset its initial cost.

Among these savings are: less hazard in storing and handling; simplified loading with its savings in time; greater work from your explosives due to complete detonation of each charge; ease in the execution of complicated shots; better control of fragmentation; the use of fewer but larger shots with less interruptions; simplicity in hooking up and firing blasts.

Perhaps *you* can use Cordeau now. It's well to know about it anyway, because the time will come when this knowledge will put money in your pocket. The Cordeau book tells the full story: free to executives.

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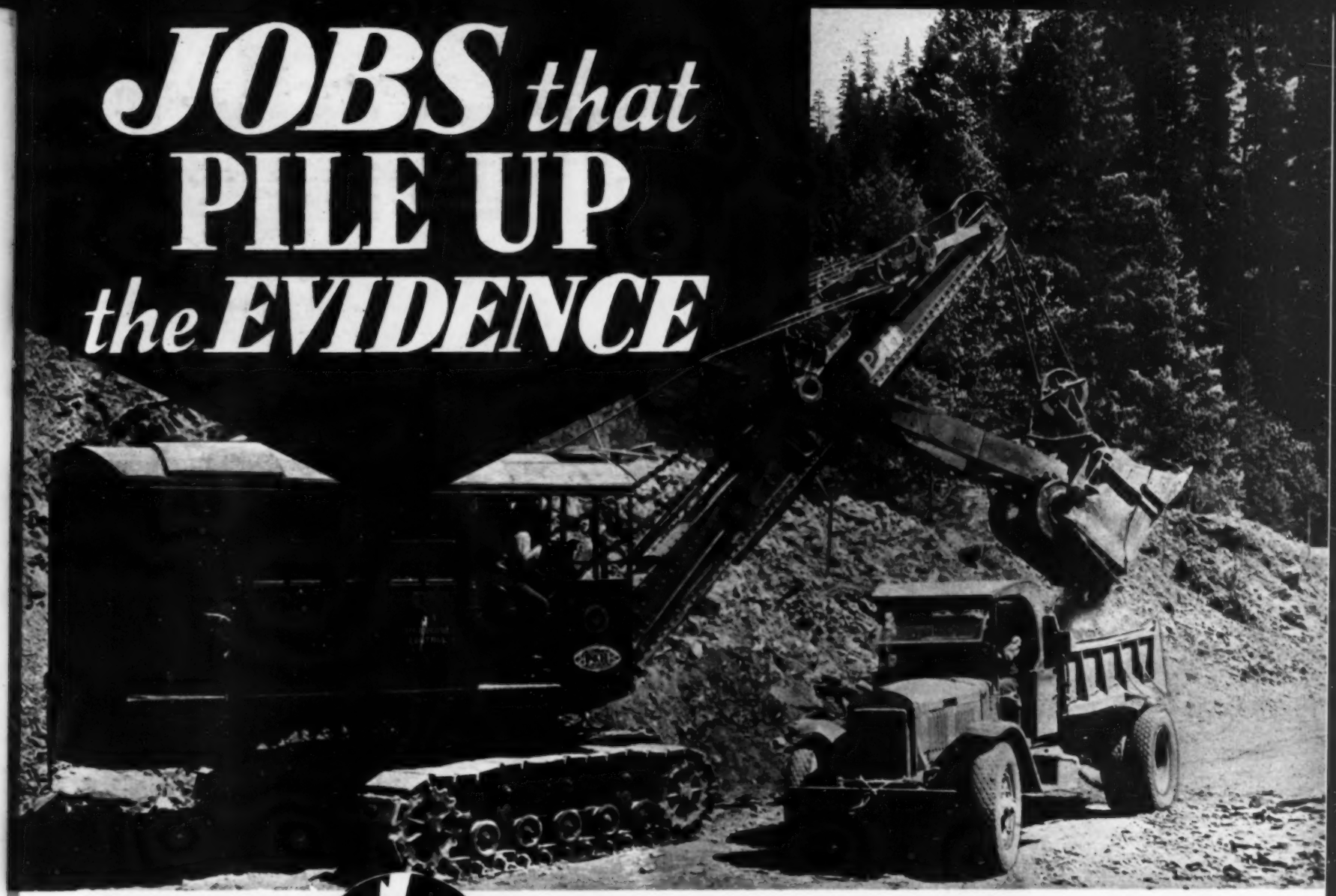
JOBS that PILE UP the EVIDENCE



What P&H split second CONTROL means in boosting yardage

Somewhere near you there's a P&H machine on the job. See for yourself the difference in performance. That's the way to understand what these new improvements mean in boosting yardage and lowering costs. We'll be glad to show you one.

IT'S not only the faster digging cycle that makes P&H performance so outstanding. It's P&H Split Second Control . . . the special shock absorbing construction . . . the sensitized power clutch . . . the easier control . . . that makes it possible for operators to get more done in a day's work with less effort. These are the fellows that are piling up the evidence of P&H superiority everyday. Ask one of 'em. He'll tell you!

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the 50th year

Excavators . . . Cranes . . . Hoists . . . Arc Welders

9 times the 50 lb. hammer drops from the highest level

and still the pipe resists failure

• Higher and higher goes the 50-pound hammer to levels unapproached in impact tests with centrifugal pipe as we formerly made it. Technical press representatives recently saw Super-de Lavaud Pipe successfully withstand 9 drops of the hammer from the maximum height of 5 feet. Average results of hundreds of less rigorous though standard tests prove that the impact resistance of Super-de Lavaud Pipe is more than doubled. This extraordinary increase in ability to resist shock is due to a basic metallurgical change in gray iron "cast without chill in a metal mold" by the patented Super-de Lavaud process. Super-de Lavaud Pipe does not shatter at bursting pressure. Send for descriptive booklet.

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U.S. SUPER-DE LAVAUD PIPE

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Get this Truck Tire with Triple Protection Against Sidewall Breaks

Don't take chances on tires when you have a time penalty contract under way. One failure on an important job this month may cost you hours of delay—men and machines idle—and a big repair bill. Did you know that 80% of these premature truck tire failures occur in the sidewall? To check this waste Goodrich built the Triple Protected Silvertown—the tire that's just as strong in the sidewall as it is under the tread! Here's a tire that takes those heavy loads and walks away with them.

Heavy loads are tough on tires. Why take chances when—at no extra cost—you can get positive protection against premature failures? Put Triple Protected Silvertowns on your dump trucks, concrete mixers and other hauling equipment. They cost not one penny more than other standard truck tires. You will get more miles—more trouble-free service.

You can save enough in reduced breakdowns and delays to pay for Triple Protected Silvertowns. These extra-rugged tires are being used wherever the going is hard. Hundreds of construction companies are getting better mileage, cutting down on tire costs.

FREE! Valuable Book

Write today for your free copy of "The Truck Operator's Handbook," full of valuable truck tire data that you can put to immediate use. No obligation. Address Department T-128, The B. F. Goodrich Company, Akron, Ohio.

See your Goodrich truck tire dealer today. Ask him to show you how these three exclusive features check 80% of premature failures:

1 PLYFLEX—a *new*, tough, sturdy rubber material with greater resistance to stretch. A layer of Plyflex in the sidewall distributes stresses and strains—prevents ply separation—checks local weakness.

2 PLY-LOCK—the new Goodrich way of *locking* the plies about the bead. Anchoring them in place. Positive protection against the short plies tearing loose above the bead.

3 100% FULL-FLOATING CORD—Each cord is surrounded by rubber. With ordinary cross-woven fabric, when the cords touch each other, they rub—get hot—break. In Silvertowns, there are no cross cords. No friction.

Goodrich *Triple Protected* Silvertowns
FOR TRUCKS AND BUSES

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115 H. P. 6-Cylinder gasoline engine . . . shovel weight 84,000 lbs. . . . anti-friction bearings . . . all-welded shovel boom and sticks . . . extra large boom-point sheaves . . . enclosed gears running in oil . . . three-side-vision, all-weather cab . . . famous Bucyrus-Erie enclosed, bevel-gear swing unit . . . easy-operating levers . . booster-set controls . . adjustable, upholstered, spring-mounted operator's seat . . . inserted-tooth dipper . . . single-shaft drive mounting . . . balanced value . . .Write for full information . . .
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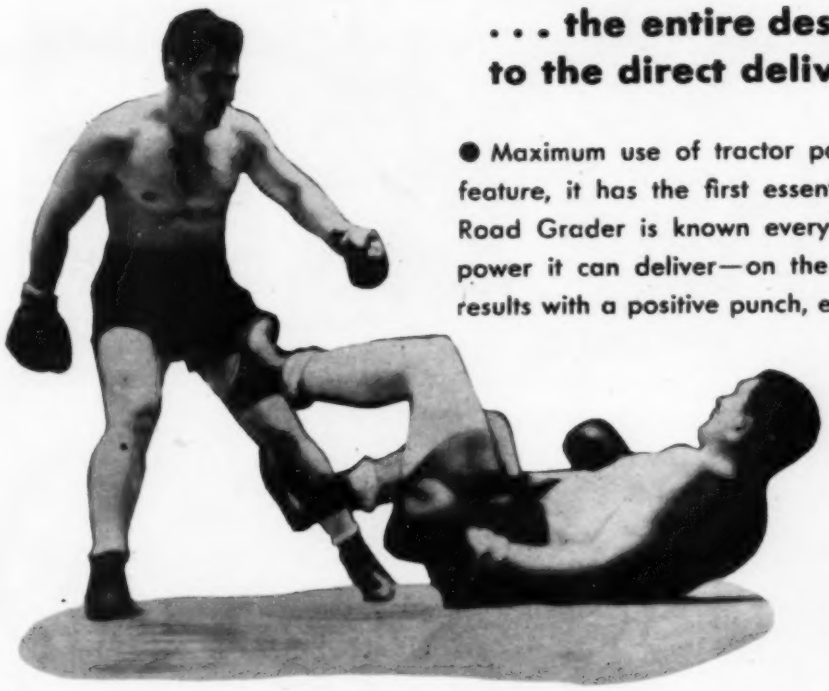
DELIVERS POWER



. . . the entire design of this grader contributes to the direct delivery of power to the blade . . .

● Maximum use of tractor power! If a road grader is outstanding for that feature, it has the first essential quality of superior performance. The Austin Road Grader is known everywhere for the punishment it can take — and the power it can deliver—on the job. The reasons for its ability to put over its results with a positive punch, even in rough rocky ground are many. But direct transmission of tractor power through the draw bar, gooseneck, and circle to the blade — in other words efficient design — is fundamental.

● Hydraulic control available except on No. 8 Grader. If you'd like to know all the engineering factors—the massive box frame, the flexibility of control—that account for Austin Road Graders' leadership, send the coupon below.

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Send me complete information on the new 8'☐, 10'☐ 11'☐, or 12'☐, Austin Grader. A-6
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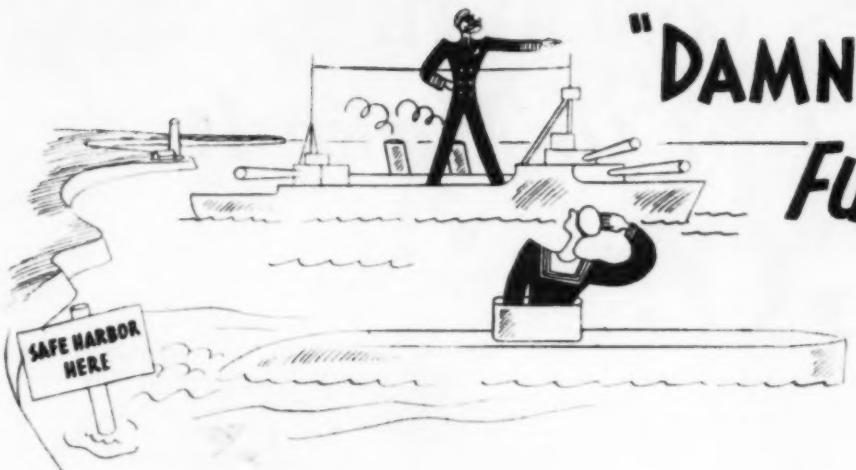
KOEHRING Wheel Dumptors operate efficiently and economically with Elevating Graders. Equal speeds, forward and reverse, permit traveling under Elevating Grader with Dumptor Bodies end to end. Continuous loading — no time lost for spotting — production increased. . . . . *Write for catalog.*

KOEHRING COMPANY
MILWAUKEE *Division of National Equipment Corporation* WISCONSIN



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"ALL SET, CAP'N... WE'VE REX '49ers ON THIS JOB"

Any construction job moves faster with Rex Construction Equipment on the job—Why?

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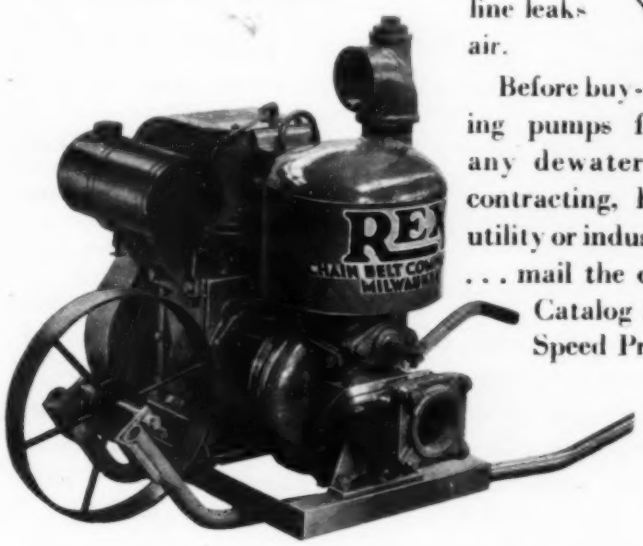
11 of the famous Rex '49ers are Pumps for every type of water pumping... including Rex Speed Prime Pumps... that work continuously at capacity so long as there is water to fill the pump... that reprime automatically if the prime is lost ... that keep on pumping even when the line leaks air.



Before buying pumps for any dewatering, contracting, bridge, utility or industrial job ... mail the coupon for Catalog 240 ... Rex Speed Prime Pumps.

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11. Moto-Mixer 2 yd.
12. Moto-Mixer 3 yd.
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22. Tower Paver
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25. Plaster and Mortar Mixer
26. Mortar Mixer No. 11
27. Speed Primer Pump 2"
28. Speed Primer Pump 2½"
29. Speed Primer Pump 3"
30. Speed Primer Pump 4"
31. Speed Primer Pump 6"
32. Diaphragm Pump 3" S
33. Diaphragm Pump 4" O
34. Diaphragm Pump 4" SC
35. Diaphragm Pump 4" DO
36. Diaphragm Pump 4" DC
37. Diaphragm Pump 4" F
38. Sludge Pump—Single
39. Sludge Pump—Double
40. Road Pump—80-gal.
41. Road Pump—195-gal.
42. Saw Rig No. 3
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44. Cold Patch Mixer
45. Contractors' Elevators
46. Bulk Cement Plants
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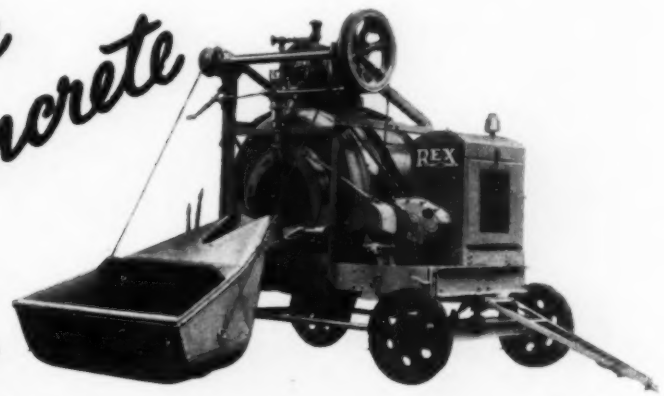
48. Belt Idlers
49. Central Mixing Plants

for concrete



26 of the Rex '49ers are in the concrete end of the business ... Mixers of all capacities for every type of job ... which mix your concrete fast and well ... Belt Conveyors, Moto-Mixers, Rex Pumpcrete ... that deliver the concrete to forms at lower cost for all conditions. Use the coupon to tell us what equipment interests you.

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THE MOST COMPLETE LINE BUILT

WHEN IT'S CONCRETE

And You've Got to Make It

GO!

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Prompt advice on concrete problems from these Universal Atlas Cement Co. offices:

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SOMETIMES you get a job where everything *has* to click—when every detail *must* be right, the first time—when you have to *drive—hard*. Then is when you give a lot of thanks to the years you've spent wrestling with every sort of tough job—to the experience that has taught you kinks and tricks—to the hard-won, drilled-in *knowledge* that a good construction man learns and keeps.

We'd be presuming a lot to suggest that we've got anything in our files or books that can tie that kind of knowledge. And we don't say that. What we do say is this—when you're working on one of those jobs that have to GO, and there's a question on concrete that has to be answered *right* and *quick*—if we can help out, we want to.

As cement people we have collected a good deal of information on concrete. We've got it sorted and filed and right at hand. Maybe there will be a time when we can use that information to help you reach the right answer on a concrete job. When we can, if you'll write or phone our nearest office (see check list above) we'll be mighty glad to try. No expense to you, of course—it's a regular part of every sack of Universal Atlas cement you buy.

UNIVERSAL ATLAS CEMENT CO.

Subsidiary of United States Steel Corporation

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Atlas Portland Cement—Universal Portland Cement—Atlas White Portland Cement (Plain and Waterproofed)

Construction Methods

ROBERT K. TOMLIN, Editor

Established 1919—McGraw-Hill Publishing Company, Inc.

Volume 16—Number 8—New York, August, 1934

WATER JET displaces sand, allowing dynamite cartridges, tied to end of pole, to be lodged against pile at required depth.

ROW OF CHARGES in place for firing by propagation-detonation method, requiring only one blasting cap for first charge.

DETONATION of one charge primed with electric blasting cap at middle of line sets off five charges on each side, thus cutting eleven piles at one shot.

DYNAMITE

Cuts Off Wood Piling in Old Jetties on

NEW JERSEY COAST

WHEN, some years ago, the Atlantic Ocean began to wash away a fine bathing beach at Beach Haven, N. J., the borough authorities took measures to stop the rapid erosion of the sand by the construction of four jetties of oak and chestnut piling. These jetties were planted in double rows so that they formed oblong structures 6 ft. wide and of varying lengths. The piles were driven down 25 ft. in the sand and just as close together as possible.

Though these safeguards against the ravages of northeast storms served a useful purpose, their removal became a problem after permanent and more sightly stone jetties were erected.

The Beach Haven Borough Council then called into consultation explosive experts of the E. I. du Pont de Nemours & Co. After a few test shots of dynamite were made, it was shown that the piling could be readily cut off to a proper depth with the explosive.

In a single day, the explosives men were able to sheer off 133 oak pilings, ranging from 8 to 10 in. in diameter. Sixty per cent quarry gelatin dynamite, 1¼ by 8-in. sticks, was used. This shooting was done with 82 sticks of dynamite and about 50 electric blasting caps with 8-ft. lead wires.

It was then decided to use 60 per cent straight nitroglycerin dynamite and to try the propagated-detonation method, whereby the shock of one explosion sets off other charges in the same line. This method worked with complete success.

The usual charge was two sticks of dynamite for each hole. For the detonating charge, three sticks were used, one of them primed with an electric blasting cap. Ten charges of two sticks each, were placed against a like number of piles for each shot. The primed charge of 3 sticks was placed against the center pile and the 2-stick charges, without caps, were placed against each of the five pilings on either side.

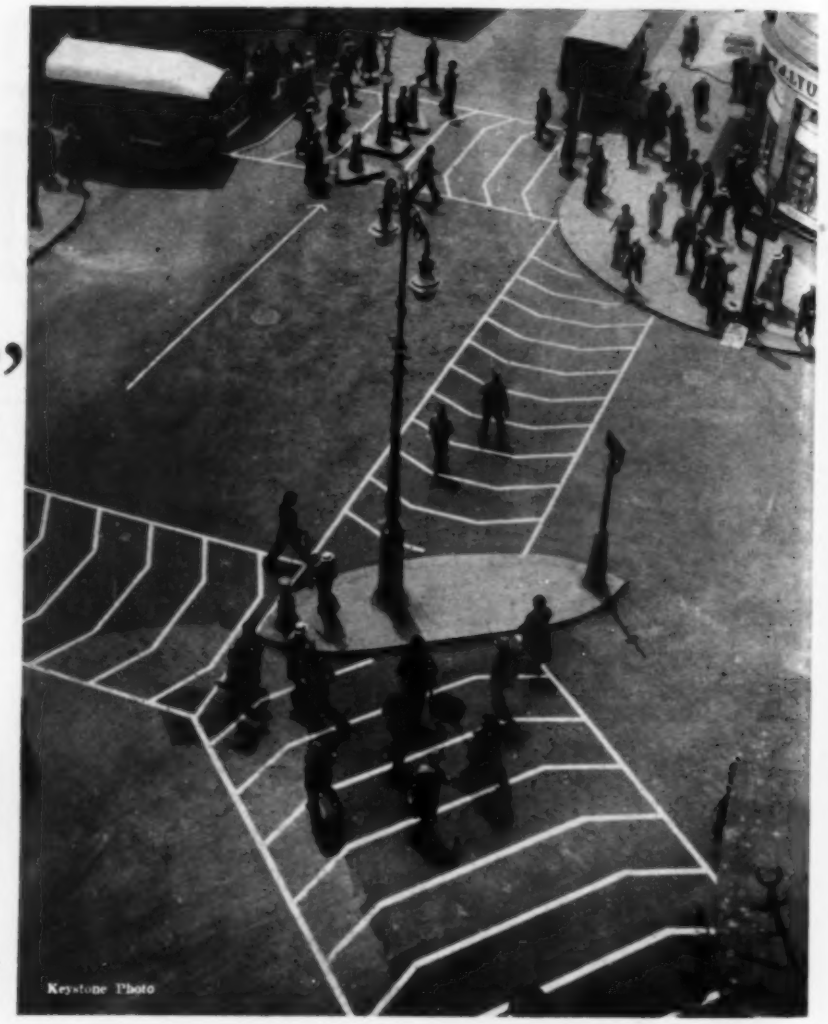
A water jet was used to remove sand and permit the loading of the dynamite. This was necessary owing to the fact that punched holes would have filled with sand immediately. The sticks of dynamite were tied to strips of wood which were pushed down as the jet of water displaced the sand. A mark on each strip of wood at a point 6 ft. from the bottom end permitted loading at a uniform depth. Sand filling the holes, when the water jet was withdrawn, firmly embedded the dynamite.

The average cost of cutting off 1,500 piles was 26½c. each. This included the cost of approximately 1,200 lb. of dynamite, 588 electric blasting caps with 8-ft. lead wires, and 6½ days' time for a blaster.

While it has been estimated that 175 piles could be cut off per day, the average was well over 200, with 318 for the peak day.

This Month's

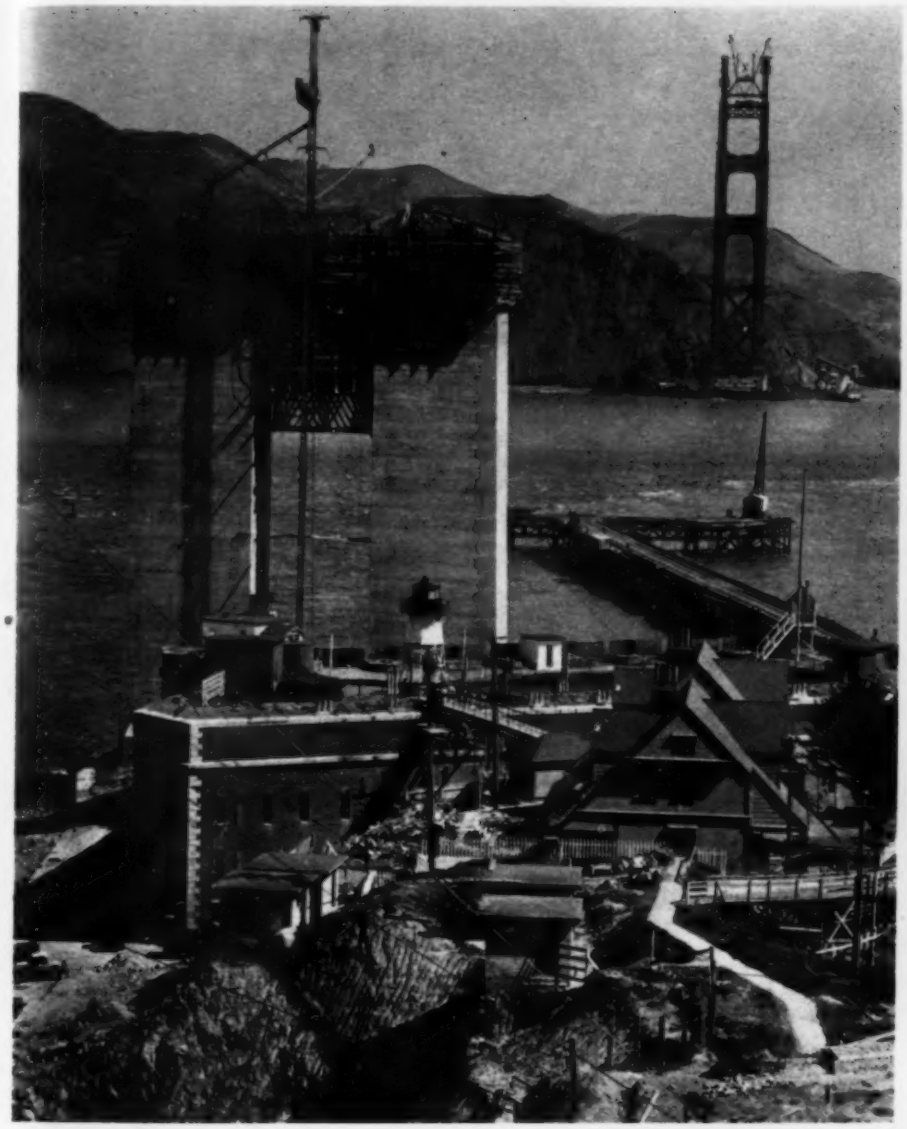
"NEWS REEL"



PEDESTRIAN CROSSINGS at 60 London street intersections are plainly marked to keep walkers within safe bounds. Regulations forbid pedestrians from obstructing traffic by "jay-walking" and provide fine of 5 shillings for violators.

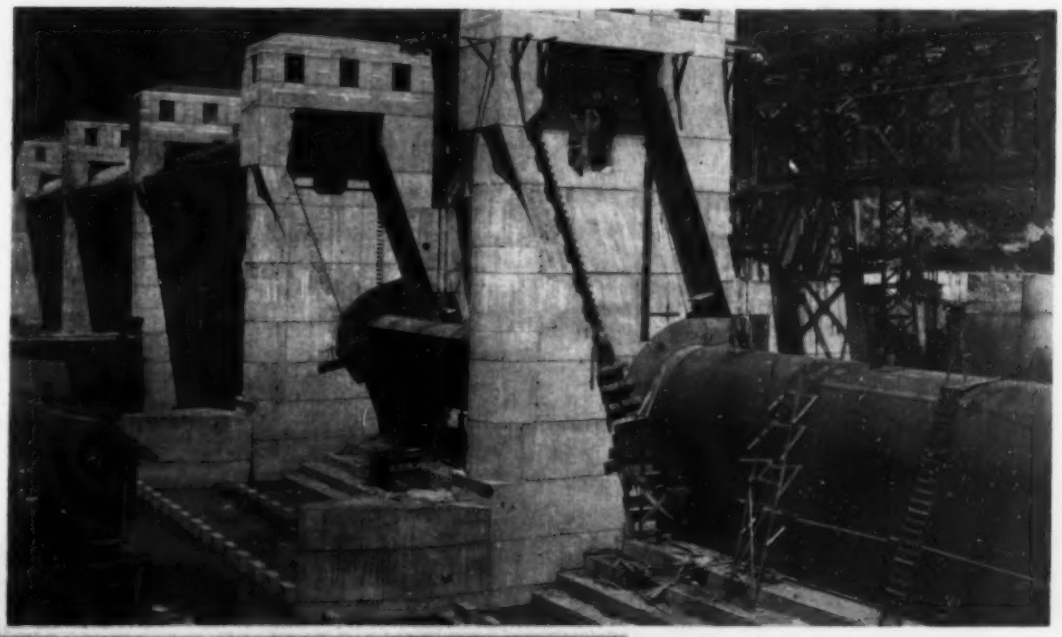
GREAT IRRIGATION DAM *(left)* with reservoir capacity of 2,140,000 acre-ft. on Cauvery River, 180 mi. southwest of Madras, soon will be dedicated by acting governor general of India, Sir George Stanley, for whom structure is to be named. Known today as Metur Dam, huge block of masonry, 5,300 ft. long and 230 ft. high above deepest foundations, contains about 2,000,000 cu.yd. of concrete and rubble masonry. Construction operations, in progress since 1926, have been aided by two traveling concrete towers. Recorded flows of river range from 800 to 436,000 sec.-ft.

MISSISSIPPI RIVER BRIDGE AT NEW ORLEANS, for combined use by railroad and highway traffic, progresses rapidly toward completion. Six of nine piers have been finished, and steel is being erected on available spans. Approach viaducts, providing space for railway tracks on deck and for vehicle roadways on brackets cantilevered out from steel towers, soon will be completed. Bridge is being built jointly by Louisiana State Highway Commission and New Orleans Public Belt Railroad.

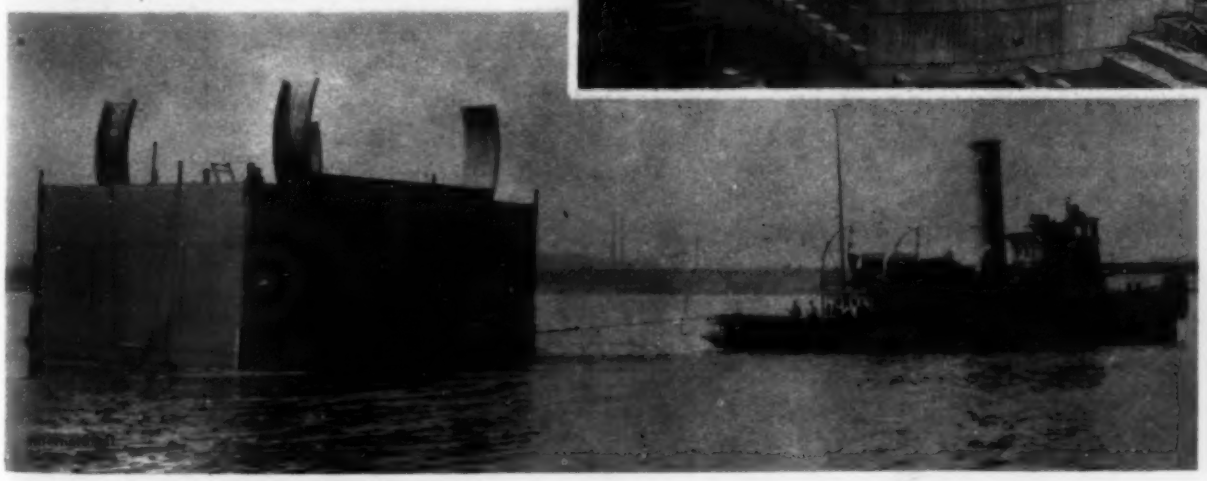


CONSTRUCTION OF GOLDEN GATE BRIDGE advances another step with beginning of work on fender wall and pier of south tower at end of contractor's access trestle extending out from San Francisco shore. Marin County tower on far shore is complete except for saddles. Photo supplied by James Reed, general manager, Golden Gate Bridge and Highway District, through courtesy of Redwood Empire Association of California.

FIRST BUCKET OF CONCRETE in Norris dam is lowered to foundation rock of east abutment at 9 a.m., July 17. Cableway transports 6-yd. bucketload from opposite side of river, where cluster of three mixers in central plant mixes concrete. Dam (being built with own forces by Tennessee Valley Authority on Clinch River, 25 mi. northwest of Knoxville, Tenn.) will be completed in 1936.



VENTILATION SHAFT CAISSON *(below)* for Midtown Hudson tunnel is towed to point of sinking in Hudson River between piers at foot of West 39th St., New York City. As launched, caisson is about 52x42 ft. in plan, with side walls 30 ft. high. Walls will be extended to 100 ft. to sink cutting edge to bedrock. Mason & Hanger Co., Inc., will drive tunnel by shield method from construction shafts on New York and New Jersey shores through circular bulkheads already partially outlined on sides of floating caisson, for Port of New York Authority.



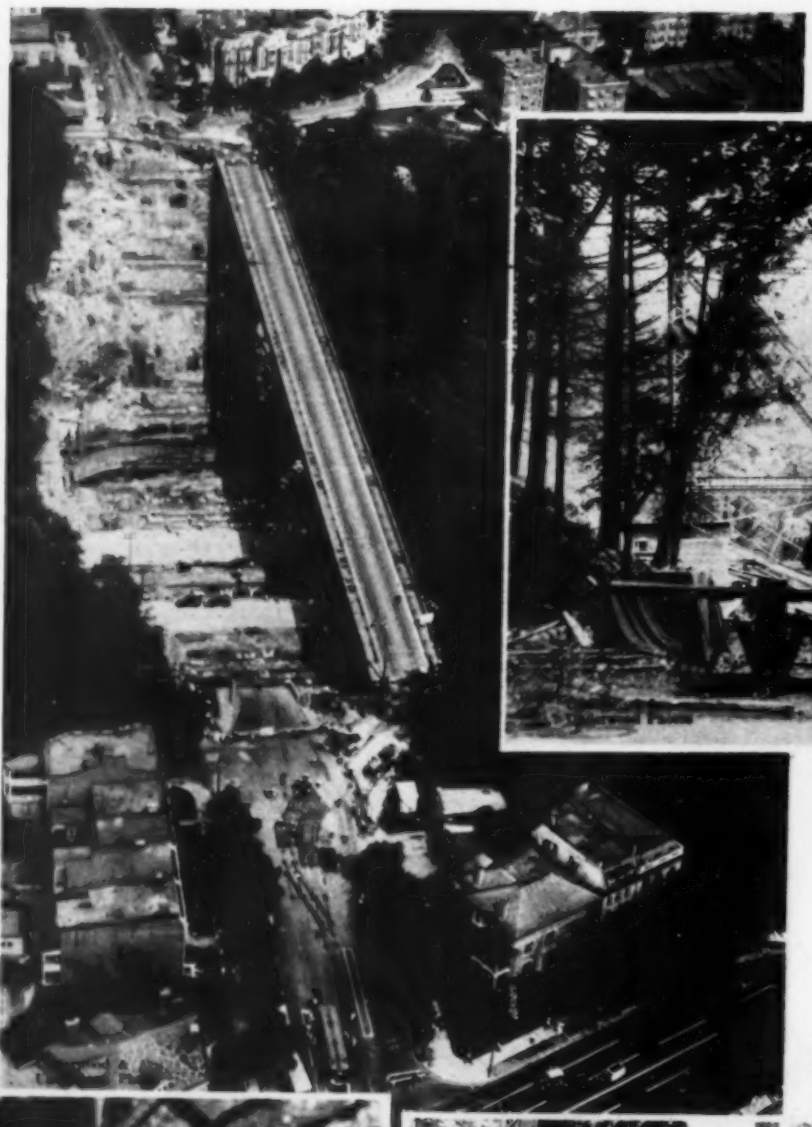
FIVE ROLLER GATES of Kanawha River dam at London, W. Va., are erected. Four gates are hollow steel cylinders 20 ft. in outside diameter and 108 ft. 5½ in. long. Fifth gate is of smaller diameter. Each gate is raised by double-link chain wrapped around one end of drum and operated by machinery in top of pier. Both ends of drum are equipped with sprockets which engage inclined racks set in sides of piers. Dravo Contracting Co., Pittsburgh, constructor, for Corps of Engineers, U. S. Army.

HORSE-POWERED CAPSTANS

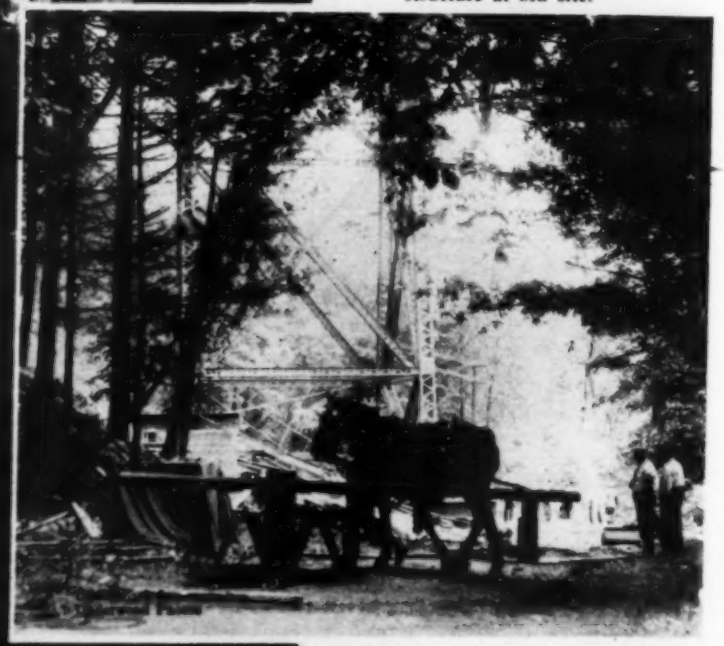
Move 1,200-Ton Calvert Street Bridge

TO PROVIDE a detour for vehicular and street-railway traffic during construction of a new Calvert St. bridge across Rock Creek ravine, in Washington, D. C., the John Eichleay Jr. Co., of Pittsburgh, subcontractor, rolled the old steel trestle (weighing 1,226 tons and rising 175 ft. above its lowest pier) from this site to new foundations 80 ft. south with the aid of five capstans, each powered by one horse, and two one-man winches. Moving of the old bridge was determined upon by the John W. Cowper Co., of Buffalo and Washington, general contractor for the entire project, as more economical than the erection of a temporary viaduct, likewise proposed as an alternative method of taking care of traffic during the period of construction by the Board of Commissioners of the District of Columbia, for which the work is being performed.

Screw jacks started the great steel trestle, 750 ft. long, upon its journey. After a number of short moves, to permit frequent checking of the structure by instruments, the rate of progress was increased, and the transfer to new position on concrete foundations was completed in 8 hr., between 7:30 a.m. and 3:30 p.m., on June 7. For purposes of moving, each tower leg of the tall trestle was picked up on a grid of steel needle beams, and the load at each leg was transferred by means of these needle beams and longitudinal girders to

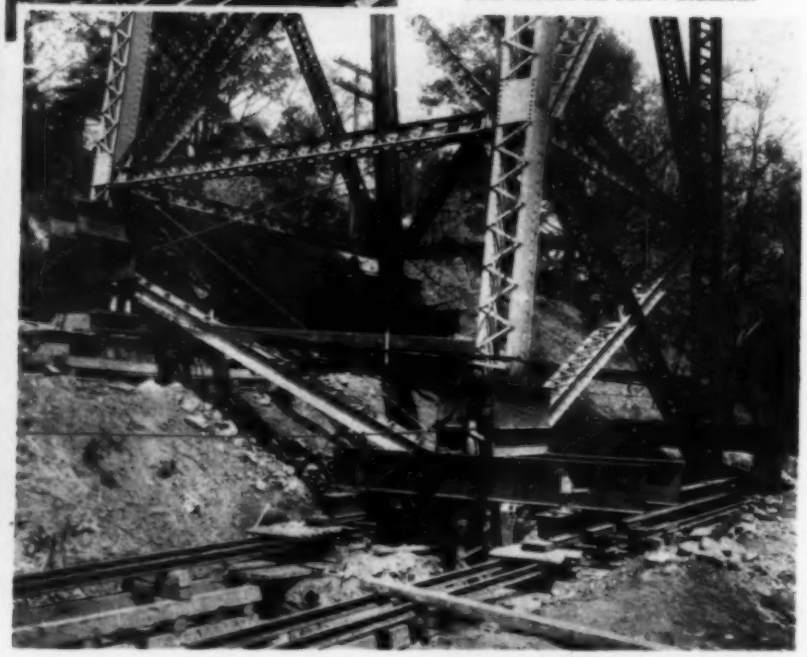


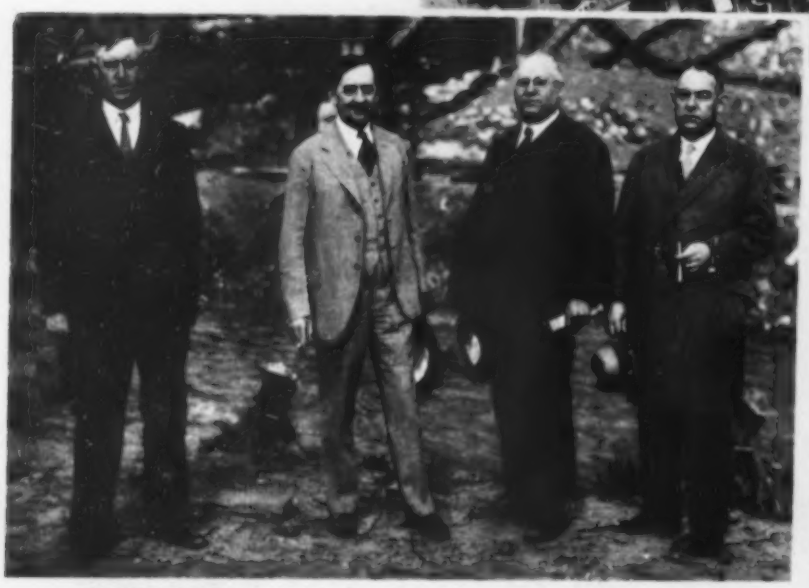
MOVED 80 FT. IN 8 HR. *(left)*, Calvert St. bridge comes to rest at new location to serve as detour during construction of concrete-arch structure at old site.



CAPSTAN TURNED BY HORSE slowly pulls bridge tower forward by means of block-and-tackle connection. Similar units operate at four other towers of long trestle.

STEEL BRACKETS *(below)* attached to tower columns transfer load to needle beams at bents 3 and 4, where stone piers are buried. Columns have not yet been burned off below brackets.





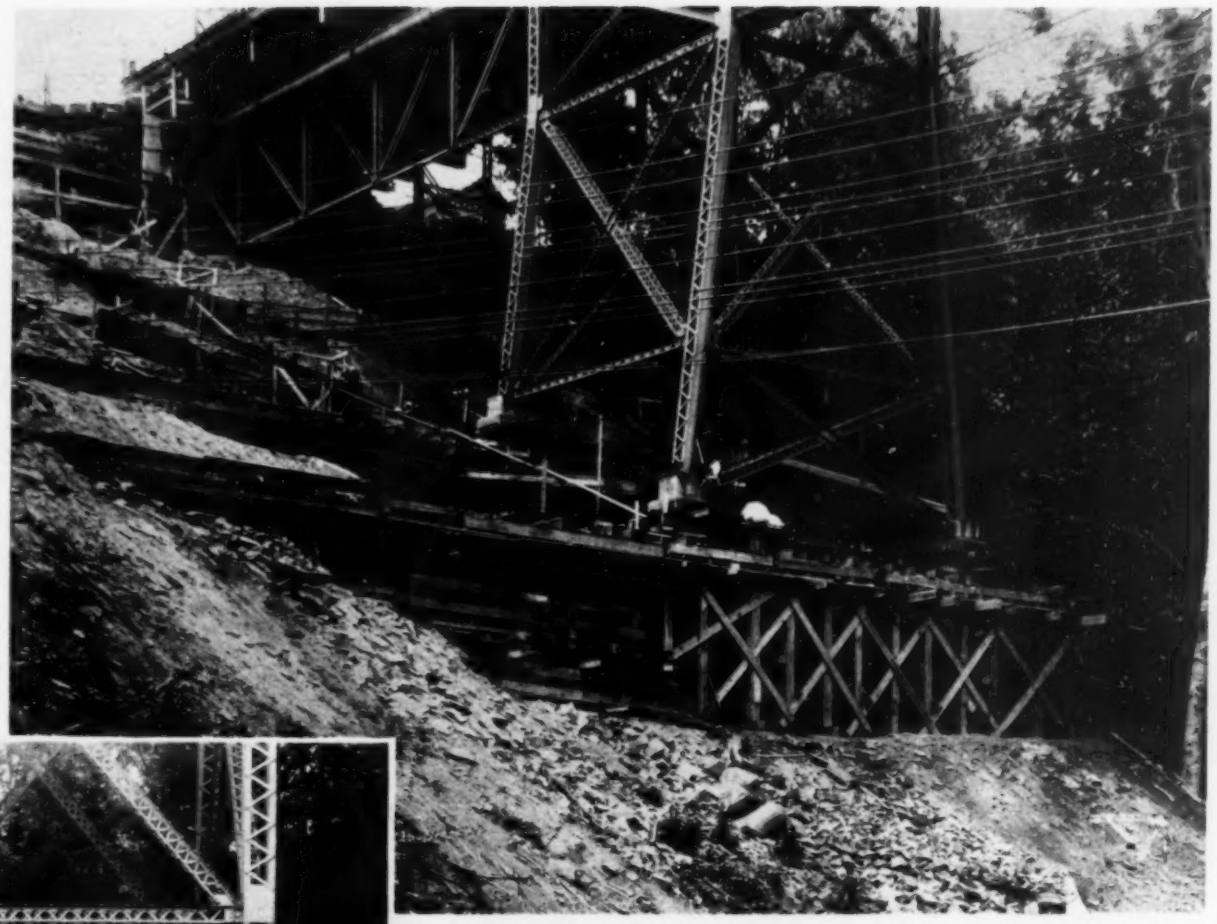
IN CHARGE OF MOVING. *(Left to right)* J. C. WALTERS, superintendent for John Eichleay Jr. Co.; FRANK M. MASTERS, of Modjeski, Masters & Case; JOHN P. EICHLEAY, president, John Eichleay Jr. Co.; and MONTGOMERY B. CASE, of Modjeski, Masters & Case.

steel rollers resting upon lines of rail laid parallel with the direction of movement. With steel-cable hauling lines leading from the two forward legs of each tower to a set of block and tackle connected to a capstan, the towers of the bridge were rolled simultaneously toward the new foundations, the drivers of the horse-capstans and the operators of the winches exercising accurate control of movement of all points.

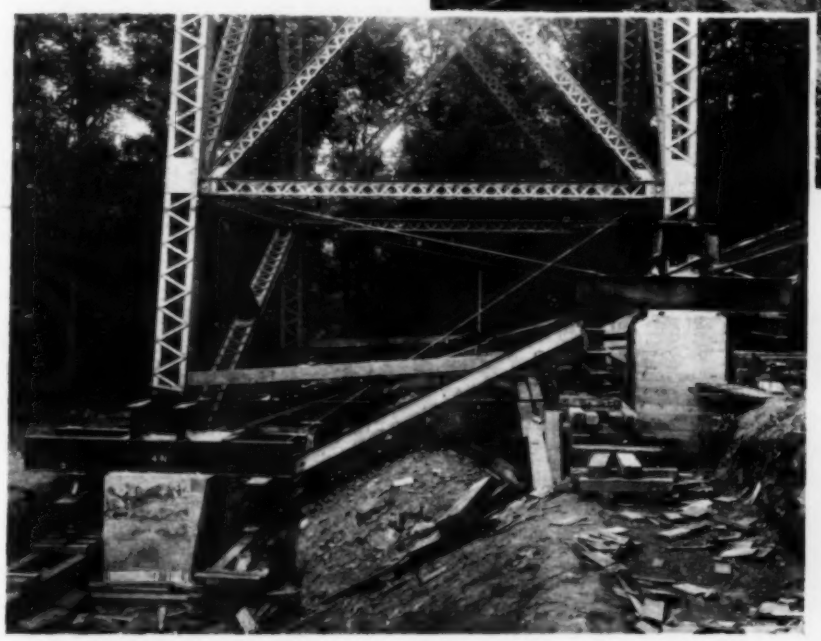
Trestle Details—As shown by the accompanying drawing, the old bridge is a deck-truss trestle, with two trusses spaced 25 ft., c. to c., supported by five towers and two abutments. Each tower consists of four laced steel columns with lattice bracing between the columns. On the two trusses rest transverse steel floor beams which support a 26-ft. timber-deck roadway, including two street-car tracks, and two cantilevered sidewalks. Span lengths are 75, 90, and 135 ft. The bridge carried a 16-in. water main, electric power lines, and a telephone conduit, all of which were provided for during the moving.

Preliminary Work—In advance of the moving, approach trestles consisting of timber bents and steel floor beams were built up at both ends of the new location. Steel rails for the car tracks were set into plank decking on the approach trestles ready for immediate connection as soon as movement of the bridge was completed.

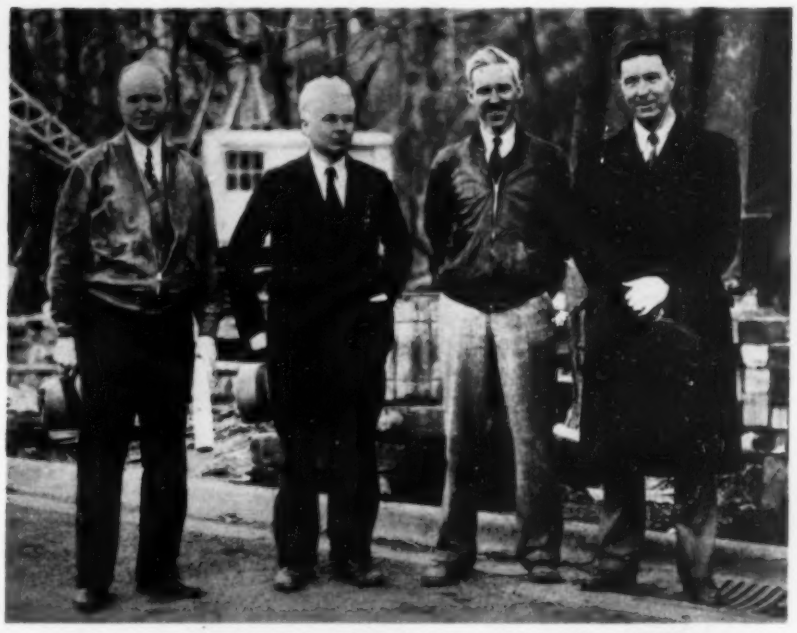
To support the steel trestle in its new location, the contractor constructed concrete piers on solid rock or sound bearing material, carrying piers down as



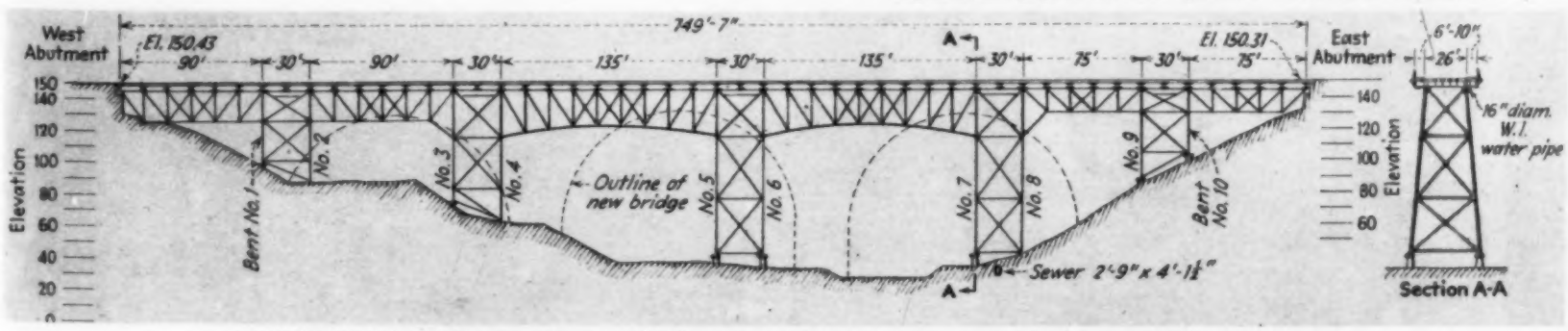
HIGH TIMBER FALSEWORK built up from uneven ground surface supports level tracks at bents 9 and 10, which have just reached final position on new piers.



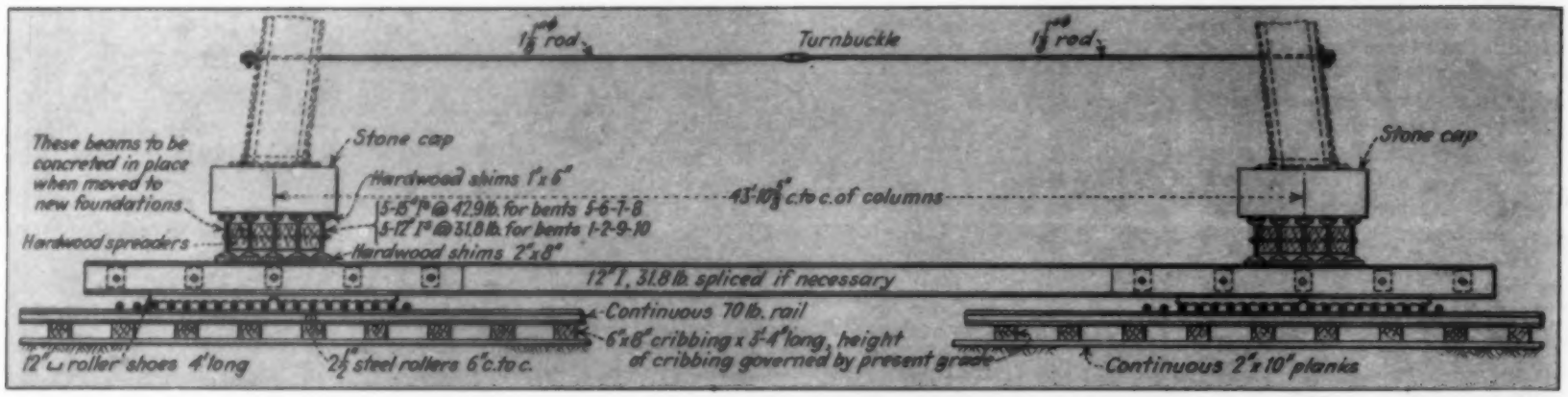
CONCRETED IN PLACE on new piers, bents 3 and 4 are ready to take traffic vibrations as soon as high-early-strength concrete hardens. Screw jacks release load from rollers and lower it on to piers.



READY TO BUILD NEW BRIDGE. *(Left to right)* F. H. MARTELL, assistant superintendent, and CHARLES B. VANNIER, superintendent, for John W. Cowper Co., general contractor; A. B. GREENE, resident engineer, and J. J. HARTKE, inspector, for District of Columbia.



STEEL TRESTLE has six deck-truss spans varying from 75 to 135 ft. in length supported by five towers and two abutments. Maximum height of structure, from stone pedestal to deck, is 125 ft. Broken lines indicate three arches of new stone-faced concrete bridge to be built on old site of trestle.


1⅛" rod
Turnbuckle
1⅛" rod
These beams to be concreted in place when moved to new foundations
Stone cap
Hardwood shims 1"x 6"
43'-10⅝" c.to c. of columns
5-8" I's @ 42.9 lb. for bents 5-6-7-8
5-12" I's @ 31.8 lb. for bents 1-2-9-10
Hardwood spreaders
Hardwood shims 2"x 8"
Stone cap
12" I, 31.8 lb. spliced if necessary
Continuous 70 lb. rail
6"x 8" cribbing x 3'-4" long, height of cribbing governed by present grade
12" ⊔ roller shoes 4' long
2½" steel rollers 6" c.to c.
Continuous 2"x 10" planks

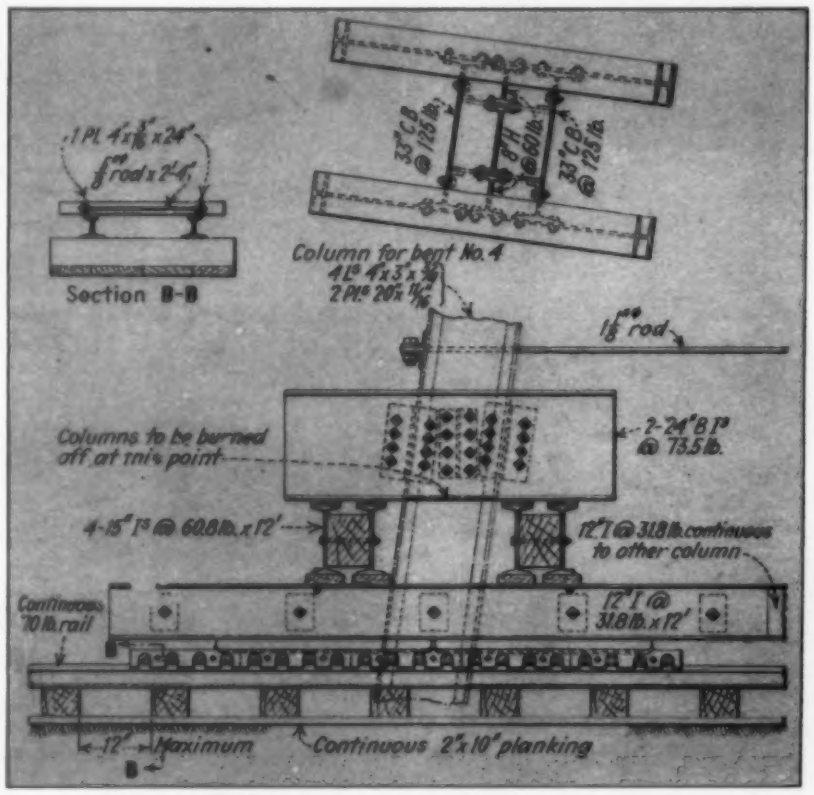
RIGID CARRIAGE supporting one end of needle beams under stone cap of typical bent transports load over double line of rails on timber cribbing. Screw jacks (not shown) between rails transfer load from pier to rollers and vice versa at beginning and end of move.

much as 30 ft. where necessary. Two lines of 70-lb. steel rails were laid parallel with the direction of movement on each side of a bent on timber cribbing built up from the uneven ground surface. The cribbing rested upon a mat of 2x10-in. planks which assured a load distribution not exceeding 1 ton per square foot during the moving operations. On top of the steel rails were placed assemblies of 2½-in. steel rollers, spaced and held parallel by means of slotted steel side plates.

Picking Up Bridge—With the exception of bents 3 and 4, all of the tower legs of the bridge rested on stone masonry piers above the ground line. At bents 3 and 4, the tower legs had been incased in concrete after the construction of the bridge to protect the steel columns against a subsequently placed fill.

At all the exposed stone piers, the contractor prepared for moving the bridge by installing a set of needle beams directly under the cap-stone of the pedestal, removing the next lower course of stone in order to place the needles. Wood wedges took up the bearings between the needle beams and the stone courses left in place, as indicated by one of the drawings.

Under the needle beams, which were installed parallel with the center line

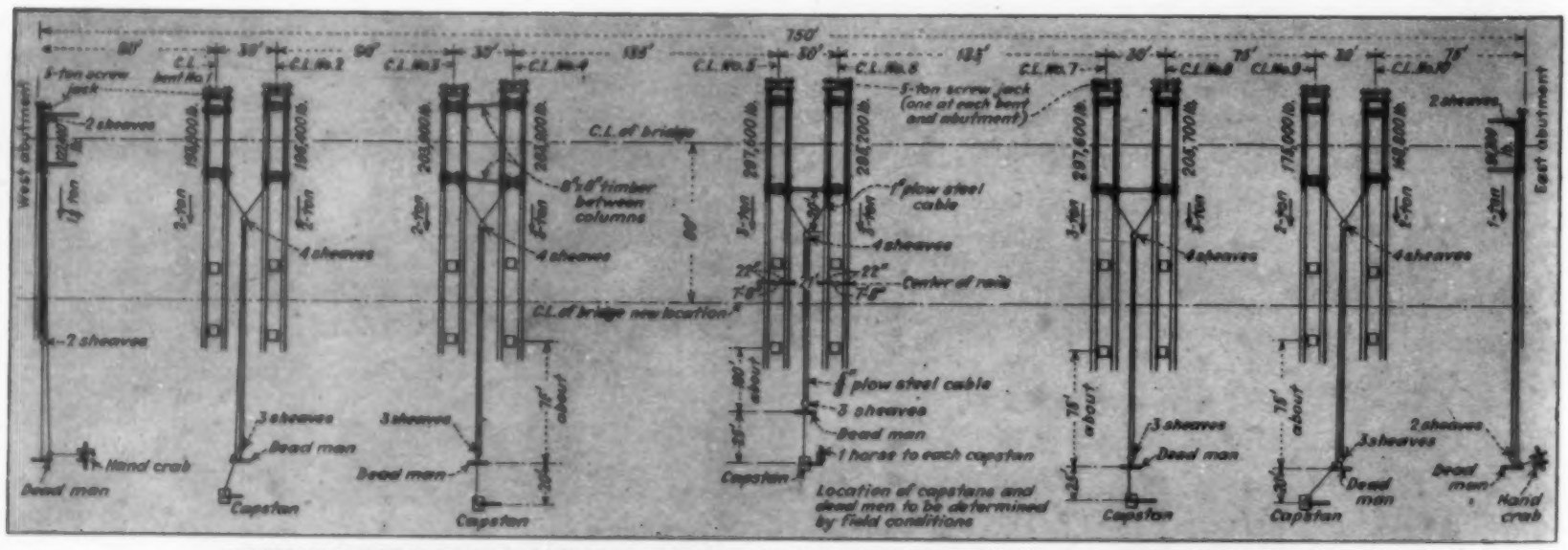

1 PL 4"x⅜"x 24"
⅞" rod x 2'-4"
Section B-B
33" C.B. @ 125 lbs.
8" I @ 60 lbs.
33" C.B. @ 125 lbs.
Column for bent No. 4
4 L's 4"x 3"x ⅜"
2 Pl's 20"x 1½"
1⅛" rod
2-24" B I's @ 79.5 lb.
Columns to be burned off at this point
4-15" I's @ 60.8 lb. x 12'
12" I @ 31.8 lb. continuous to other column
Continuous 70 lb. rail
12" I @ 31.8 lb. x 12'
12" Maximum
Continuous 2"x 10" planking

AT BENTS 3 AND 4, structural brackets fastened to columns rest upon pairs of needle beams supported on rigid carriages. Columns are burned off below brackets.

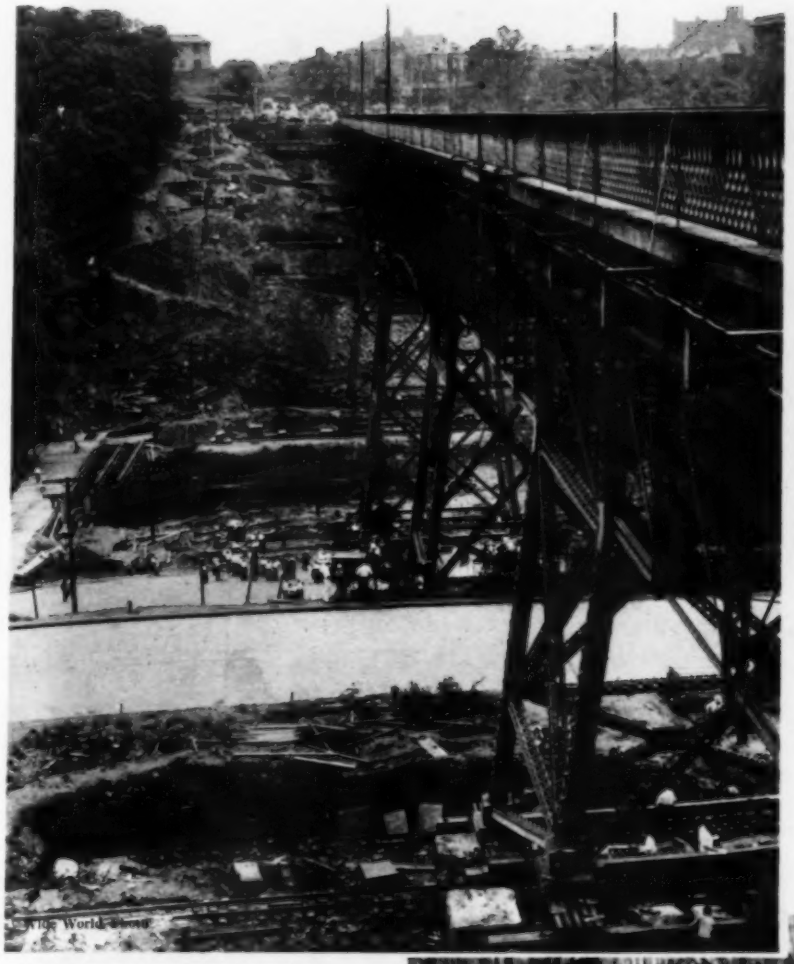
of the bridge, the movers placed two pairs of 12-in. beams 12 ft. long, one pair at each end of the needles, directly above the steel rails of the track prepared for rolling. These pairs of 12-in. beams rested upon two sets of steel-shod rolling shoes bearing directly upon the assemblies of 2½-in. steel rollers. One beam of each pair was spliced by means of a connecting member to one beam of the other pair traveling on the same set of rails, thus framing the temporary supporting steel under the two columns of the bent into a rigid carriage. Batteries of screw jacks were employed to raise and lower each tower leg at the beginning and end of its journey.

At bents 3 and 4, the contractor bolted steel brackets to the columns, and, after transferring the load by means of these brackets to the temporary carriage and track structure, workmen burned off the columns below the brackets. Except for using bolted steel brackets instead of capstones, the procedure at these bents was similar to that at the other towers.

Moving Procedure—Horse-powered capstans and hand-powered winches were selected for the moving operation because these old-fashioned devices provide the most dependable and most easily regulated control of motion at

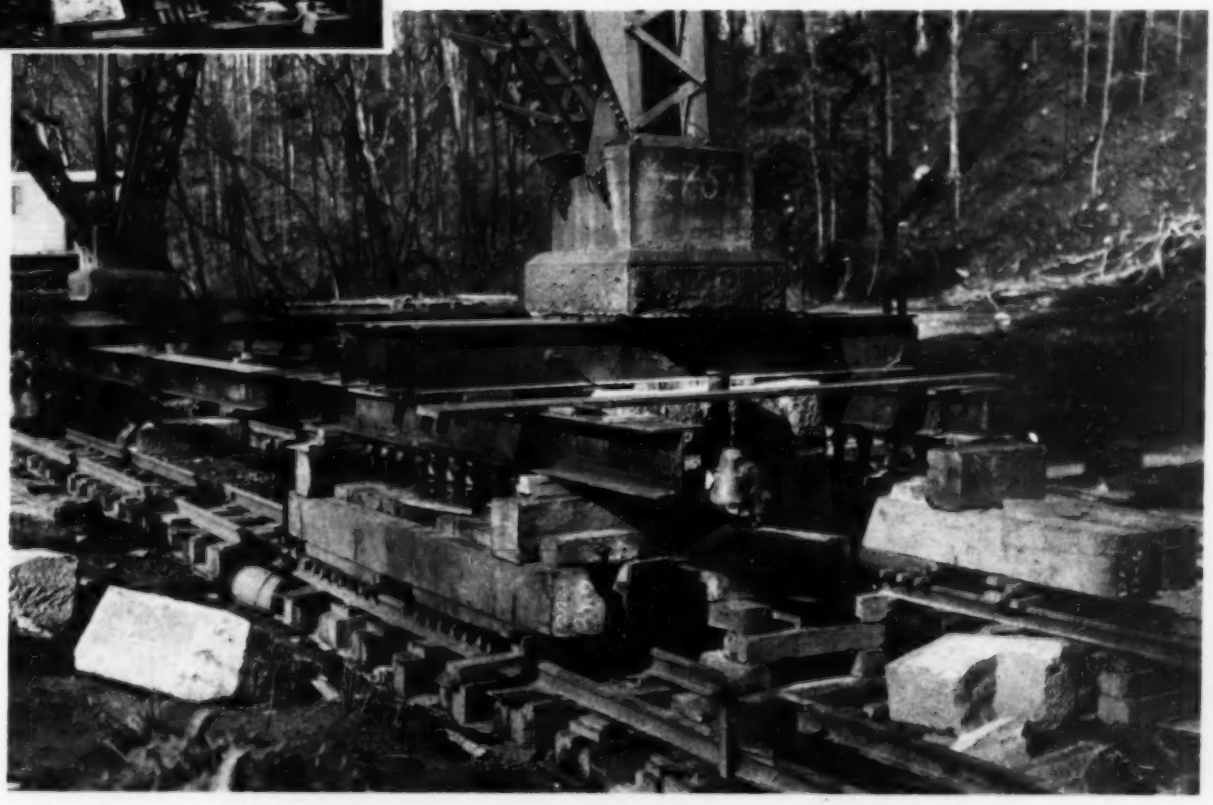


SEVEN SETS OF BLOCK AND TACKLE, rigged up from bridge towers and abutments to horse capstans or hand crabs, suffice to move bridge to new position 80 ft. distant. Screw jacks at rear of carriages start structure on journey. Towers are hooked to block and tackle by steel-cable bridle from base of two forward columns.



TALL STEEL TRESTLE 750 ft. long moves to new position on rigid structural carriages drawn forward on steel rollers traveling over steel-rail tracks.

MANUALLY OPERATED SCREW JACKS raise and lower tower columns as required to transfer load from piers to rollers or vice versa. Slotted steel side plates hold rollers in line.



INSTALLATION of needle beams, rollers, rigid carriage and screw jacks under bent preparatory to moving.

a number of scattered points. After study of several hauling hook-ups, the layout indicated on the accompanying diagram was chosen as simplest and most direct. The diagram gives both the vertical load at each bent and the horizontal pulling force required to overcome inertia and frictional resistance of the steel rollers.

Screw jacks of 5-ton capacity operating against the rear ends of the carriages started the bridge on its movement from the original position. The contractor had intended to move the structure only 4 in. by this means, but the jacks shoved the bridge so easily and smoothly that the movers decided to extend them to their full length of 8½ in.

Beyond this point the moving was accomplished by the hauling tackle rigged up to the capstans and winches. At each of the five towers, an eight-part line of 5-in. steel cable was rigged up to a house-moving capstan operated by a horse. A four-part line reeved to a hand crab sufficed to supply all the needed pulling force at each abutment. With the simultaneous application of pulling power at seven points, the bridge moved forward slowly and uniformly on its rollers.

For the first 7 ft. after the shove with the screw jacks had been completed, the bridge was pulled forward in increments of 6 in. to permit the engineers to make frequent checks of alignment and grade between pulls. For the remainder of the distance, the length of the individual moves was increased to 12 in. The engineers continued to make careful checks at several points, both for alignment and for grade. At no point did the bridge get more than 1½ in. out of level, and alignment was maintained within 2 in. throughout. Close observation of the structure during movement revealed no undue stresses.

At the end of the move, screw jacks lowered the grillages on to the new concrete piers, and the grillage beams were concreted in place with high-early-strength concrete.

Administration—Moving of the old bridge and construction of the new bridge at the same site are being performed for the Board of Commissioners of the District of Columbia under the direction of Maj. John C. Gotwals, engineer commissioner; Capt. H. W. Whitehurst, director of highways; Clifford R. Whyte, engineer of bridges; and A. B. Greene, resident engineer.

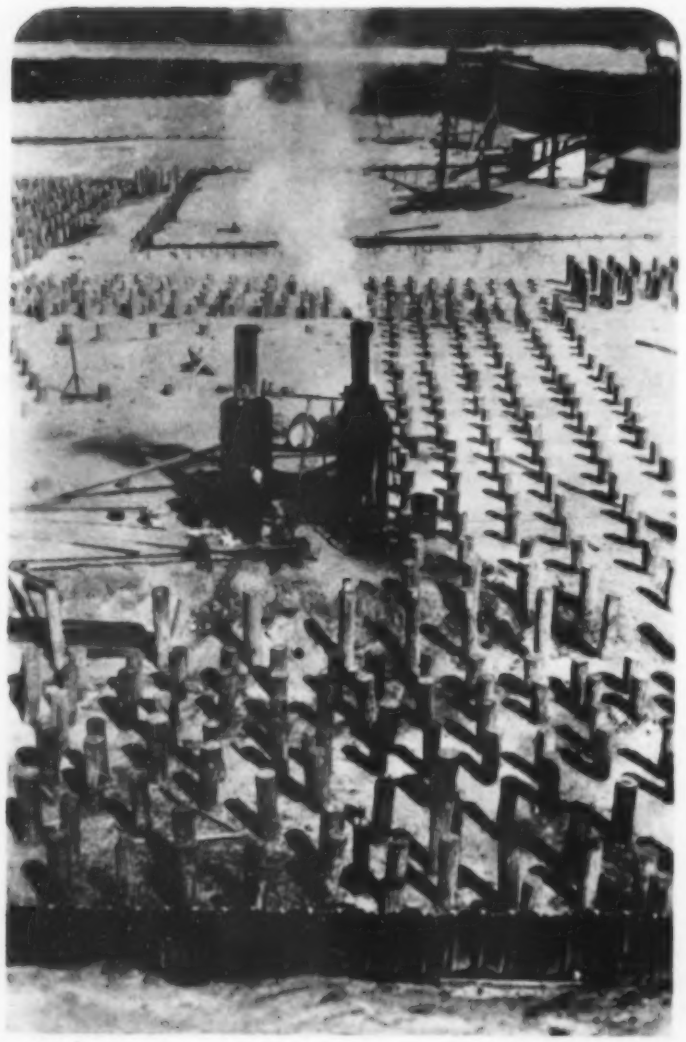
For the John W. Cowper Co., of Buffalo and Washington, general contractor, the work is supervised by S. K. Pierce, vice-president; George Herman, general superintendent; Charles B. Vannier, superintendent; and F. H. Martell, assistant superintendent and engineer. The subcontract of the John Eichleay Jr. Co. for moving the bridge was executed under the direction of J. P. Eichleay, president, and J. C. Walters, superintendent. Modjeski, Masters & Case, of New York City, are consulting engineers for the project.

PRIOR TO INSTALLATION OF WELL POINTS four vertical pumps lower water level to El. 526, about 8 ft. below winter stage in river. Further excavation below this level has to await well points because inflowing seepage water washes sand from cofferdam embankment toward deeper holes.

WELL-POINT SYSTEM

Dries Up Clean Sand Subsoil of

MISSISSIPPI RIVER COFFERDAM



WITH WELL POINTS IN OPERATION *(left)* contractor excavates 30 ft. below flood stage of river and drives piles in dry. Sheetpiles in foreground form cutoff of land wall of lock.

A SYSTEM of 600 well points and eight self priming 8-in. pumps lowered the water level a maximum distance of 20 ft. inside a 7-acre cofferdam and permitted the Central Engineering Co. of Davenport, Iowa, contractor, to excavate in the dry for the foundations of Lock 16 on the Mississippi River opposite Muscatine, Iowa. The lock is built on a deep deposit of clean, sharp sand, and all the lock wall footings and gate sills rest on wood piles. A steel sheetpile cofferdam 1,640 ft. long was constructed by the contractor to inclose the lock area of 7 acres. Because of the permeable character of the foundation material this cofferdam could not stop infiltration in large volume into the foundations. Lowering of the water level inside the cofferdam area was started with vertical centrifugal pumps and was completed with the well points, which rapidly drew down the water level below the elevation of the deepest footings.

Construction Conditions—A cofferdam area 1,000 ft. long and 330 ft. in width at its widest point was required to construct: (1) two complete walls for an initial lock soon to be put into service at this point, and (2) a short section of wall for a potential second lock to be completed in the future if river traffic justifies it. This short section of wall provides the south abutment for a dam which will be placed under contract within a year. At the site of the lock, the clean, sharp sand of the river bed contains, according to the contractor, less than 1/10 of 1 per cent silt. This condition is typical of the upper reaches of the Mississippi River, where the swift current at flood stages scours all silt deposits.

River bed at the lock is about 525 ft.

above sea level, and the flow level at low water is about El. 534. Spring floods normally raise this level 9 ft. to El. 543. To take care of a flood of this height the contractor constructed a box cofferdam with two rows of arch-web sheetpiles, spaced 20 ft. apart, with the top of the outside row at El. 547 and the top of the inside row at El. 543. The two faces of the cofferdam are tied together with tierods, which are anchored at both ends by nuts and nut washers bearing against double channel wales. Before the cofferdam was closed, the space between the sheetpile walls was filled with sand pumped by a hydraulic dredge from the lock area.

Lowering Water Level—In general, concrete footings of the lock walls and gates are at El. 516 or El. 514.5. After the cofferdam had been pumped out by four vertical pumps to about El. 526, sand boils in the embankment along the inside of the cofferdam and the flow of sand from this embankment into the deeper parts of the excavation created a hazardous condition which the contractor promptly combatted by installing a system of well points.

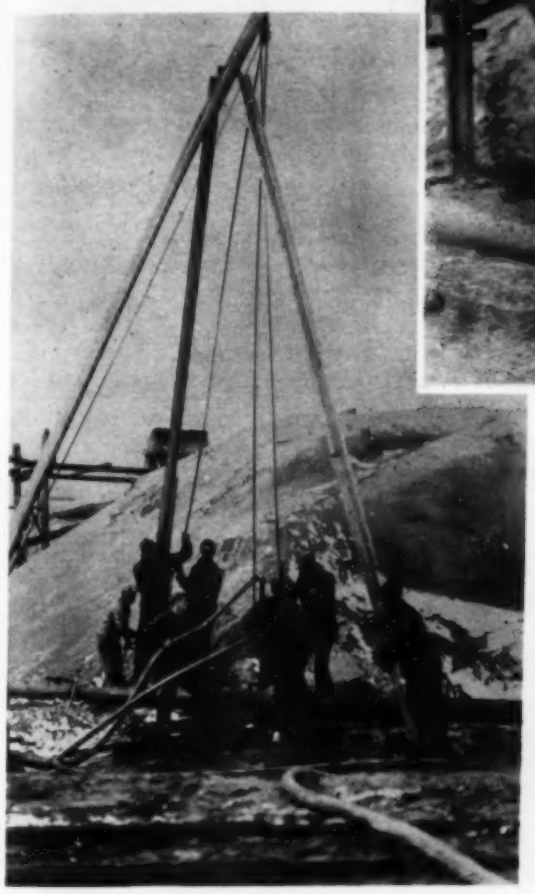
For the original well-point installation, the contractor procured 450 Moretrench well points 27 ft. long and six Moretrench 8-in. pumps. According to the plan then contemplated, this equipment was to lower the water level in one-half of the area at a time. As scheduled in this plan, the original installation was made around the east or upstream section, the headers being laid at El. 525.

Five of the 8-in. pumps and about 1,600 ft. of 8-in. header pipe were used to form a complete drainage system surrounding this area. Along the headers adjacent to the cofferdam, well points were installed at 3-ft. intervals, the spacing was made 6 ft. along the land sides of the system. Within 48 hr. after the system had been put in service, the water level was reduced to El. 514, and the excavators were able to begin operations in the dry. Three of the vertical pumps, in the central and upstream areas were taken out of service when the water dropped to this level.

A number of well points and one 8-in. pump were kept in reserve to equip supplemental intermediate headers which the contractor expected would be needed inside the area to lower the water level still further for the deepest foundations. Because of the success of the first installation in reducing the general water level in the area to meet all construction requirements, the contractor elected to omit all cross headers and to utilize this extra equipment to

NEW-TYPE WELL POINT *(right)* ready for jetting. Grid of steel bars protects fine-mesh screen. Point attaches to 2½-in. pipe which extends almost to top of unit.

AFTER JETTING TO POSITION, each well point flows as artesian well, indicating that groundwater is under pressure seeking outlet through sand to surface.



TRIPOD RIG and hose connection to pressure water pipe are used to jet 27-ft. well points into sand.

600 WELL POINTS and eight 8-in. pumps are installed to lower water level in working area. Along cofferdam, points are spaced 3 ft. apart.

8-IN. HIGH-VACUUM PUMP draws water from 8-in. header to which well points are connected. Pump can take care of about 2,000 g.p.m.

extend a header downstream parallel with and adjacent to the cofferdam, connecting well points to this header at 3-ft. intervals. One 12-in. vertical pump still was functioning in the down-stream area.

At the end of several days' pumping in February, with the river at a low stage of about 534, the well-point system in the up-stream area had reduced the water level to about El. 513. Because of the high permeability of the sand, the groundwater flow had a very slight gradient from the center of the area toward the well points, the level at the center of the area being generally less than 1 ft. above that at the headers.

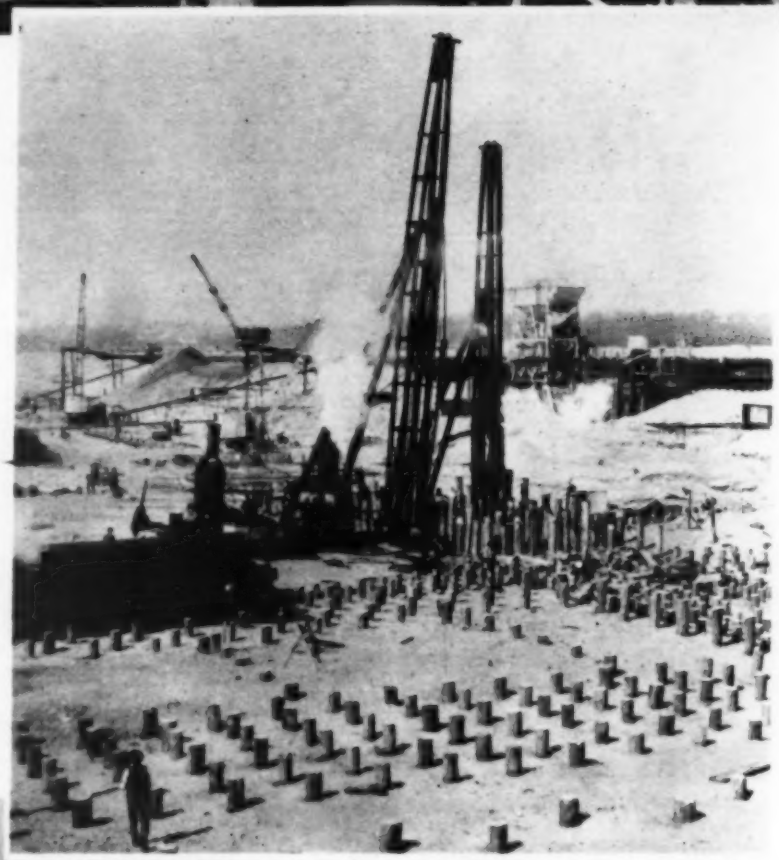
To guard against possible delays in constructing the deepest footings when the hydraulic head would be increased 9 ft. by spring floods, the contractor installed a supplementary system of 150 well points and two pumps parallel with the previous header along the river side of the area. Well points of this secondary system, spaced 6 ft. apart, drew down the water level to a still lower elevation. Excavation was carried to El. 512 with the river at a flood stage of 541.8 without any appreciable amount of seepage.

CONSTRUCTION OF LOCK proceeds inside cofferdam without interference of seepage water, even during spring floods.

Well-Point System — Success of the well point system in this installation is dependent upon its ability to drain the soil from below without causing any loss of sand. Self-priming, high-vacuum pumps with an effective suction lift of 25 to 30 ft. draw water into the system through fine mesh screens 270 sq. in. in area near the lower ends of the well points.

Well points installed at Lock 16 are of a new type decidedly different from that previously manufactured by the Moretrench Corp. The new design retains the two valve ports controlled by floating ball checks which permit: (1) jetting of the points into the ground, and (2) withdrawal of water from the surrounding soil by suction. Instead of the wood backing which was banded to the 1¼-in. pipe of the old type, the new design employs a 2½-in. pipe extending almost to the top of the well point. In the new type, also, a grid of steel bars is used to protect the fine-mesh screen, replacing the heavy wire screen protection of the old well point. The cross-sectional area of the new point is about one-half that of the old.

All the well points were installed by jetting, using a tripod, as illustrated, and a Moretrench jetting pump capable of delivering 500 g.p.m. at a pressure of 125 lb. per square inch. The self-priming 8-in. centrifugal pumps utilized in draining the well point have capacities of 1,950 g.p.m. at 1,200 r.p.m. against a head of 50 ft. These pumps are driven by 40-hp. electric motors.



PILEDRIVERS move over dry sand at El. 514 in putting down foundation piling for lock structures.

DRY DIGGING starts 48 hr. after first installation of well-point system begins functioning.

Direction—Construction of Lock 16 is being directed for the War Department by Maj. R. A. Wheeler, district engineer, U. S. Engineers Office, Rock Island, Ill. O. R. Ramser is resident engineer on the project.

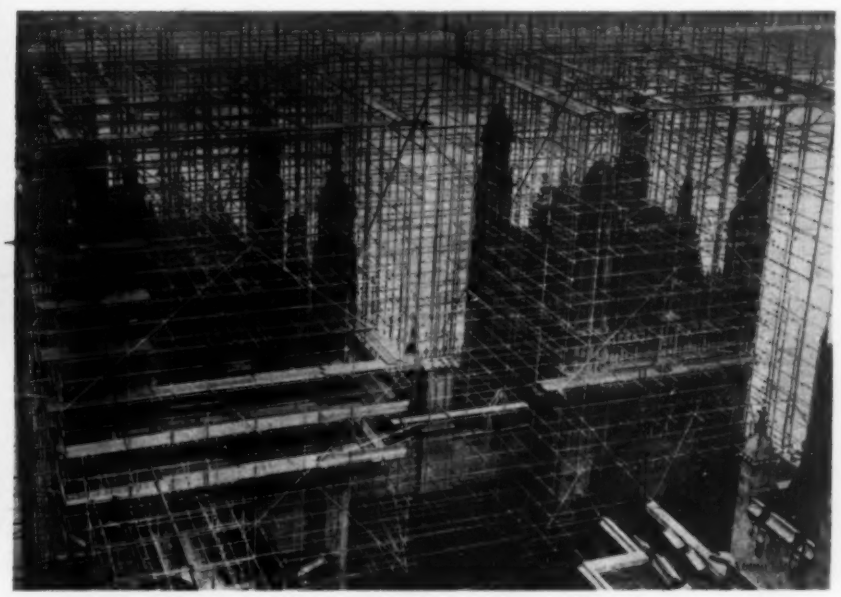
For the Central Engineering Co., O. G. Nobis, vice president, is in general charge of the work. John Tunnicliff, superintendent, directs operations on the job.

JOB ODDITIES

A Monthly Page of
Unusual Features of Construction

AMPHIBIAN ENGINEERS of Metropolitan Water District of Southern California, led by Carl Heilbron, enter water-filled section of Fan Hill Siphon on Colorado River Aqueduct to make strain tests with aid of extensometer, measuring diameters of conduit in various directions under hydraulic load. Equipment includes phones and diver's helmet built in District's shops by member of aqueduct organization, Vernon Sheffield, former professional diver.

SECTION OF 30-FT. PENSTOCK of type installed in tunnels at Boulder dam reveals great size of pipe in comparison with modern building for benefit of visiting members of American Society of Mechanical Engineers, meeting in Denver, where pipe section was erected in front of U. S. Custom House.



NETWORK OF TUBULAR SCAFFOLDING envelops Speaker's House, London, being renovated with other buildings of British Houses of Parliament.

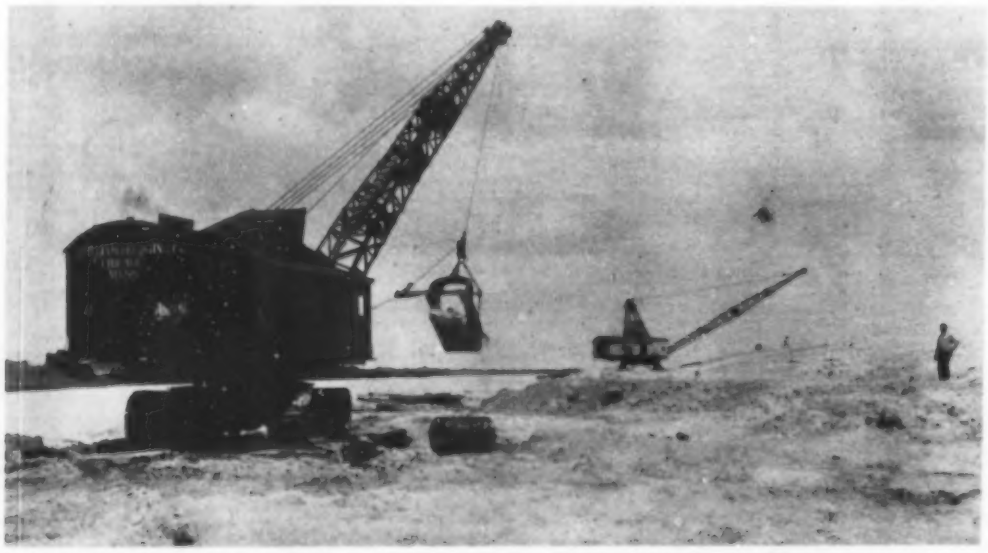
PROTECTION PIER 430 ft. long, for 375-ft. swing span of Chicoutimi bridge across Saguenay River, Quebec, is among largest ever built. Pier consists of line of steel sheetpiling inclosing pivot pier at center and concrete island at each streamlined nose. Between these concrete structures sheetpiles, bolted to framing of timber cribs, alternate in lengths of 65 and 30 ft. to save steel and allow water to circulate. A. Janin & Co., Ltd., of Montreal, contractor.

LEVEE BUILDING AT

Draglines and a 66½-Mile to Curb Flood Florida

BUILDING 66½ mi. of levees along the indefinite margin between the northern edge of the Everglades and the varying shallow waters of broad Lake Okeechobee in the lower third of the Florida Peninsular as a protection against flood tides resulting from hurricanes involves numerous problems in material handling and in manipulation of the construction plant employed

At its normal maximum water level Lake Okeechobee covers about 725 sq. mi., making it one of the largest fresh water areas wholly within the United States. It is fed by three streams having a combined watershed of 4,176 sq.mi. on which the average annual rainfall is from 45 to 60 in. Water levels in the lake range from 12 to 21 ft. above tide water, with the lake bottom in the deepest places about at sea level. Under natural conditions, Lake Okeechobee overflowed into the Everglades. Some of the surplus water probably eventually reached the sea at the southern tip of the peninsula 100 mi. from the south shore of the lake.



SMALL DRAGLINE builds working berm, while large machine in background finishes levee slope.

Everglades History—Following more than 100 years of local and entirely unimportant attempts to drain the Everglades, serious efforts to that end were begun about 1913. Between that time and 1926 four canals were dug from the lake in a generally southeasternly direction to the Atlantic Ocean. These canals, one of which is more than 80 mi. long, were intended principally to remove the surplus rainfall in areas adjacent to them. To take care of the excess water in the lake, a canal was built straight east from the latter to the Atlantic. Low levees, built along the south shore of the lake, were placed to prevent overflows into the Everglades.

So little was known about the Everglades when these various works were started that less was accomplished by the improvements than had been contemplated. Then, in 1926, a great hurricane that swept across the lake pushed a vast amount of water over the levees into the Everglades, with resultant great damage to improvements that had sprung up behind these levees. Again, in 1928, an even more violent hurricane following a path across the lake, wiped out most of the remaining improvements along the south shore of the lake and killed probably 2,500 people.

Meanwhile, financial conditions in Florida had become such that the undertaking of adequate flood protection work, which by this time it was evident would have to be far more extensive than originally planned, was beyond local resources. The Federal Government finally worked out a combined navigation and flood protection project to meet the situation. This project was originally estimated to cost $9,000,000 of which $2,000,000 was to be supplied by the land directly benefitted and the remainder by the Federal Government.

Present Project—For protection against the overflow resulting from hurricanes a levee 66½ mi. long is being built along the south shore of the lake, with a short stretch of levee along a low section on the north shore. The canal leading from the lake directly eastward to the Atlantic is being improved, and a river channel westward from the lake to the Gulf of Mexico is being widened and deepened. With these two created lake outlets, it is expected that surplus water from the lake will be diverted entirely from the Everglades. These outlets, together with a channel dug by borrowing to build the south shore levees, also will provide 6-ft. navigation across the state from the Atlantic to the Gulf. The design provides for deepening to 8 ft., if and when traffic justifies such an improvement.

While a good deal of construction work had been done in and around Lake Okeechobee before the present work began, there was very little accurate information on which to base the design and construction of levees of the

LAKE OKEECHOBEE

Dredges Construct Embankment Tides Created by Hurricanes

height and section involved in this project. The Corps of Engineers, United States Army, which is in charge of all features of the design and construction, made extensive studies before deciding on the type of levee and various auxiliary works required in the improvement. Local soil and other conditions are so unusual, however, that since the work has been under way it has been found desirable to make a number of modifications in the original levee design. Construction experience obtained on the project also has permitted various advances to be made in the methods employed.

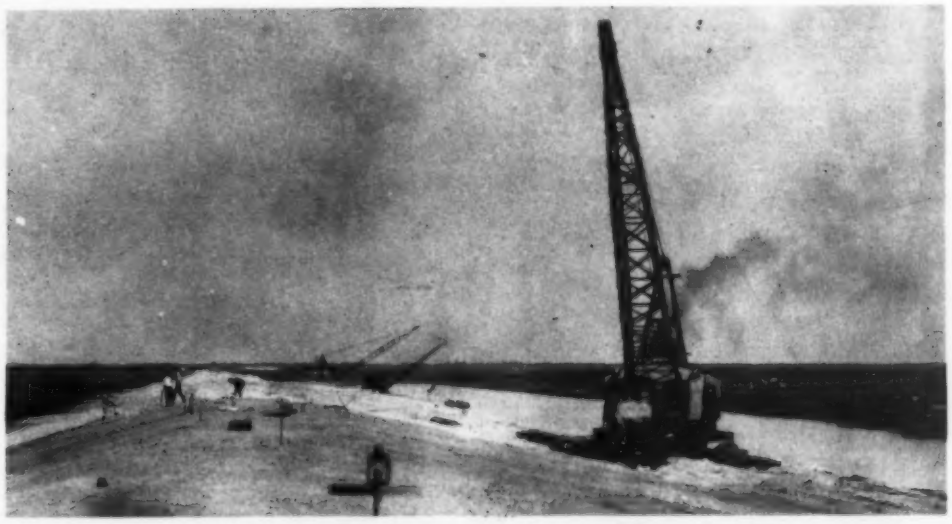
The almost perfectly flat south shore of the lake is only 21 ft. above sea level. The indefinite swampy margin of the lake consists of a heavy growth of reeds and coarse grasses, with no trees and practically no brush. A layer of muck, varying in depth from a few inches to as much as 12 ft., occurs along the shore line of the lake and southward practically across the Everglades. Where this muck is shallow it consists of partially decomposed fibrous roots of grasses and reeds. In greater depths the lower part of the layer of muck is the same material further decomposed. Any of this muck will burn when dry. It is almost impervious when undisturbed. Piles are driven through it with difficulty. When loosened and moved the muck becomes quite unstable and totally unsatisfactory for levee construction.

Underlying the muck is generally a deep stratum of marl. In most places a thin layer of soft limestone, having a quite irregular pothole and pinnacle surface, occurs between the marl and the muck. Extensive pockets of sand and sea shells are common in the marl. Total lack of uniformity adds to the difficulty of constructing levees and other works on such foundations.

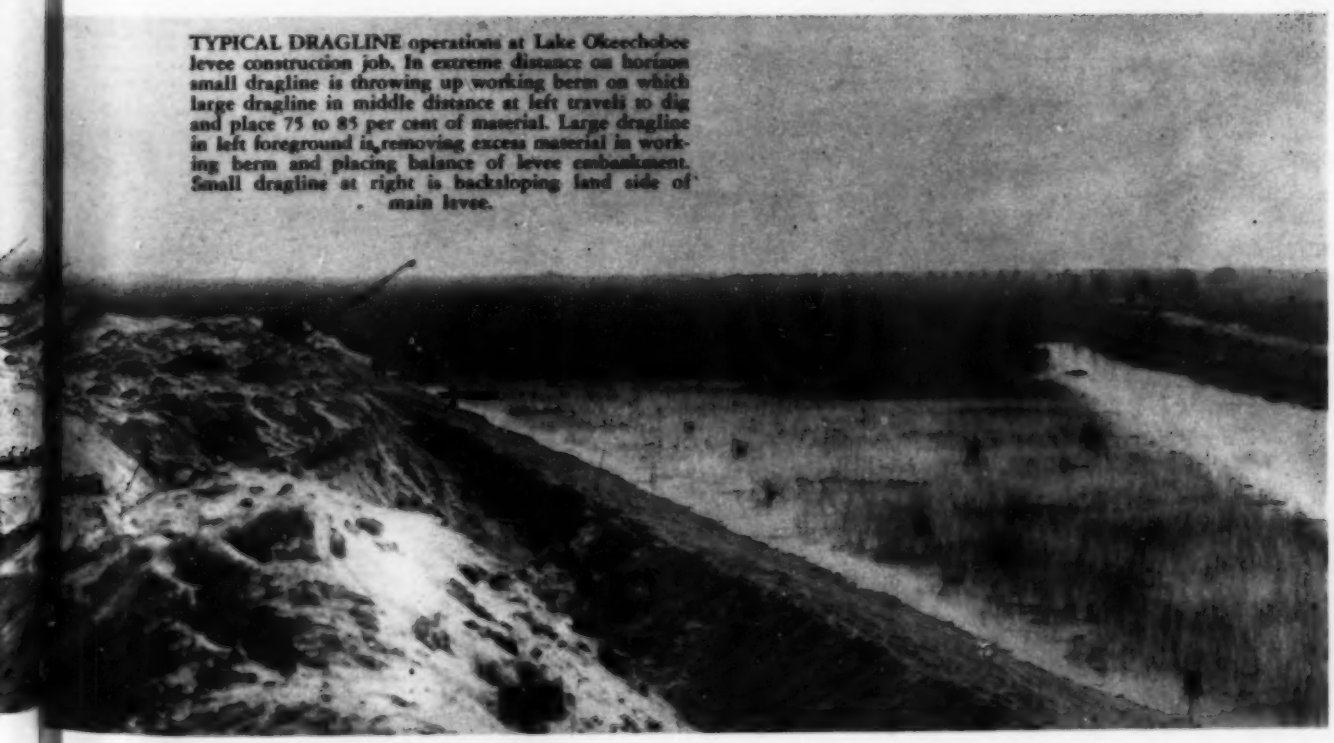
Levee-Building Methods — Two methods of building levees were contemplated when bids for the project were requested. One provided for the use of the 175-ft. boom draglines that have been standardized on work of this class on the lower Mississippi River. The other was based on placing the levee embankment with hydraulic dredges.

Excepting one 15-mi. section, all of the levee work has been let to contractors. One contractor having a 6.5-mi. section elected to use hydraulic dredge methods. All of the others have installed draglines and dipper dredges. On one section, on which work had been under way only a short time when these notes were prepared, the contractor is using 175-ft. boom draglines. All of the other dragline contractors have machines with shorter booms and are accordingly doing some rehandling.

In all of the levee along the south shore of the lake the crest of the finished fill is at El. 34. On the dragline section the land side slope generally is on 4, but is slightly flatter under certain conditions. On the lake side of the dragline section, the standard slope is 1 on 6. A berm on a 1 on 10 slope extends from the toe of the lake-side slope of the main fill out to meet the bed of the lake. Material for the fill is borrowed offshore from the outer



FINISHED SODDED LEVEE in foreground, with borrow pit forming navigation channel on right.



TYPICAL DRAGLINE operations at Lake Okeechobee levee construction job. In extreme distance on horizon small dragline is throwing up working berm on which large dragline in middle distance at left travels to dig and place 75 to 85 per cent of material. Large dragline in left foreground is removing excess material in working berm and placing balance of levee embankment. Small dragline at right is backsloping land side of main levee.

edge of this flat berm. The borrow pit is first stripped of muck when necessary and then dug to a minimum depth of 6 ft. for a bottom width of 80 ft.

Contractors are not required to strip muck from the site of the levee fill. To prevent fire working under the fill, a trench 12 ft. wide is dug through the muck at the location of the land-side toe of the levee and is backfilled with material other than muck. Along the lake-side toe of the main embankment, a trench of similar width is dug through the muck and backfilled with satisfactory material to prevent seeping under the levee.

With the standard dragline section adopted, machines having 175-ft. booms can take from the borrow pit all material required and place it in the levee without rehandling. On account of the common use of shorter boom

DRAGLINE EXCAVATOR *(below)*, on Atlantic Dredging & Construction Co. job, handles material typical of much of digging.

machines on this job various expedients have been adopted in placing equipment to reduce to a *minimum* the amount of material rehandling required. The plan of procedure followed by the McWilliams Dredging Co. on the second of two sections which that concern contracted to build, shows how well such planning has been done to keep costs down.

This contractor has two 125-ft. and two 50-ft. boom draglines working in one set-up. One of the smaller machines proceeds ahead just outside the toe of the permanent levee berm and throws up with material from the borrow pit a false berm well above the normal water level in the lake. One of the 125-ft. boom machines then follows on this false berm and with material from the borrow pit, places 75 to 85 per cent of the main embankment.

The second 125-ft. machine follows to dig from the borrow pit the remaining material required to complete the levee. This second large machine in one motion places the material where it is required. In the same position as it proceeds along the job it also removes the excess material previously placed in the working berm and deposits this excess in the main levee fill. Only a small percentage of the total embankment thus has to be rehandled.

The second small dragline digs and refills the fire cutoff trench. It also places along that toe of the main levee a low fill ahead of the first large dragline to prevent loss of the material placed by the latter. As the main fill progresses, this second small dragline also back slopes to the final grade.

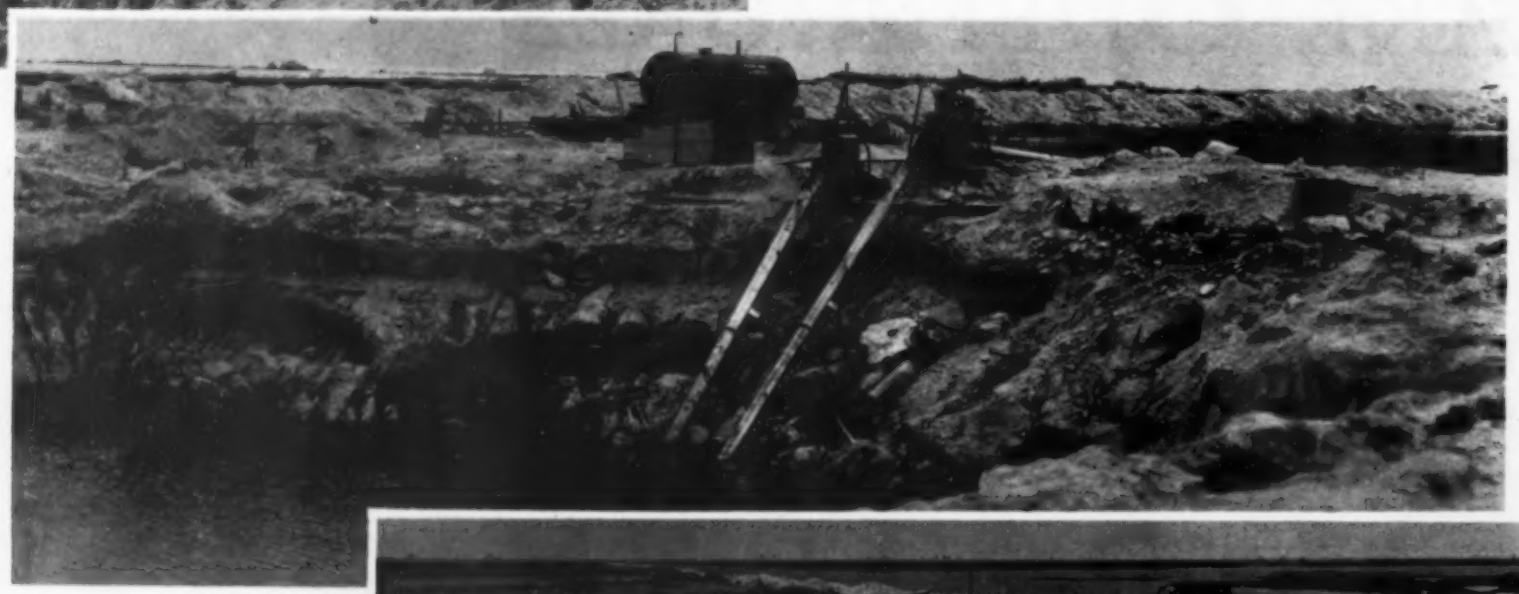
Unwatering Borrow Pit— F. A. McKenzie, president of the Atlantic Dredging & Construction Co., has worked out on a section which his concern contracted to build, a method of unwatering the borrow pit that has shown large savings in the cost of handling the material. Mr. McKenzie previously had tried this method successfully on a smaller scale in building a highway fill under similar conditions. Based on the experience on that job, he first undertook to unwater a 1,500-ft. section of borrow pit on this project. The results were so good that he extended this method to handle all of his 3.6-mi. contract. Other contractors on the project also have adopted the same method of procedure.

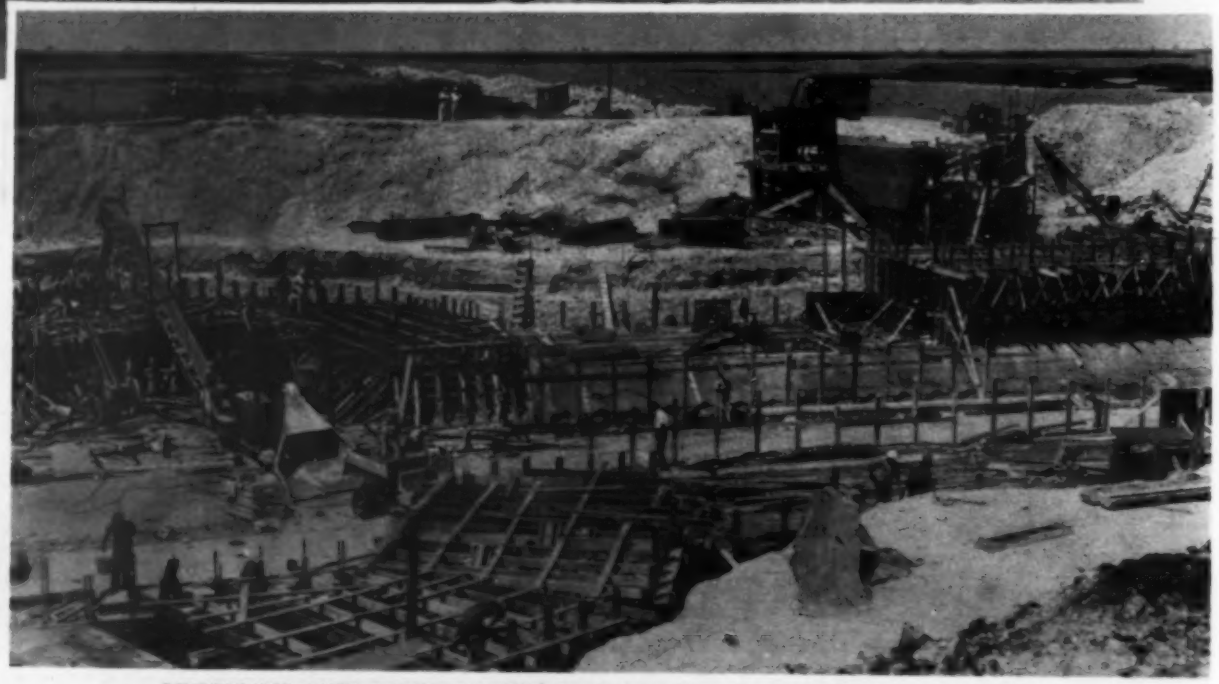
At the start of this dry-pit method the first step is to have a small dragline throw up a low dike well beyond the lake side of the borrow pit parallel with the axis of the main levee. A second low dike is then thrown up beyond the landside of the levee site and cross-fills are placed to inclose the length of borrow pit that it is intended to unwater. Then the inclosure is pumped out and the excavation handled in the dry.

Under the local conditions the same equipment digging from an unwatered pit to make the levee fill will handle at least 50 per cent more material than when excavating under water. When the dragline bucket comes up from a submerged borrow pit, it never has more than a struck-measure load, and it usually carries considerable water. The same type of bucket digging in the unwatered pit nearly always brings up an overload.

One other important factor favoring the unwatered pit method on this job is that the marl in most cases is hard to hold in place when it has been stirred up in water. When dug from the unwatered pit the marl is much easier to handle in the fill.

SET-UP *(below)* of two portable pumping units unwaters borrow pit more than 5,000 ft. long.





HURRICANE-GATE CONSTRUCTION by E. H. Latham Co. on south shore of lake. Belt conveyor delivers concrete from mixer into wooden forms.

With the unwatered pit method, such drilling and blasting of the rock as is necessary can be done in the dry. The saving in cost for this part of the job, as compared with under-water drilling and shooting, is a considerable item.

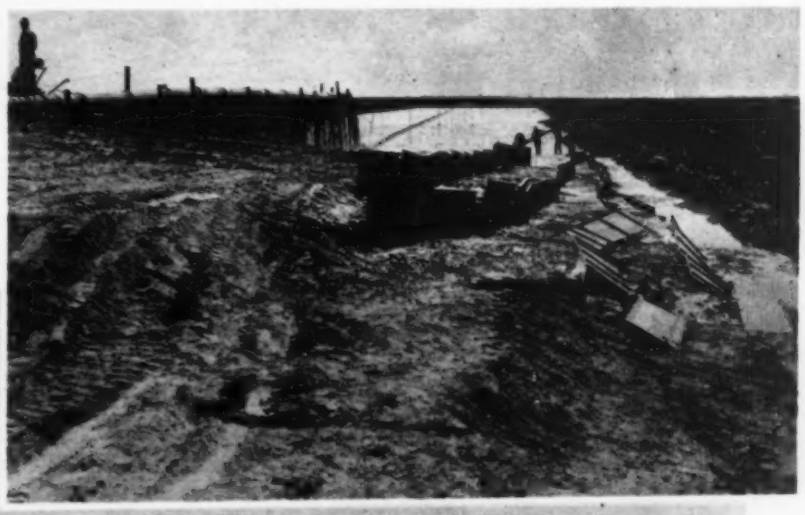
Pumping Equipment — Unwatering of the long borrow pit has been comparatively simple with portable turbine pumping outfits. The muck that forms the bed of the lake along the site of the levee is practically impervious under the low head against the retaining dykes. The marl below the muck also lets comparatively little water through. As a result, the total amount of seepage is relatively small. Excessive rainfall generally also can be removed as soon as is needed.

Designed especially for this job by The Couch Manufacturing Co. of Plant City, Fla., the portable pumping outfits have proved quite economical and effective. An L-shaped welded steel pipe, with the vertical leg long enough to reach to the bottom of the borrow pit, provides the mounting for the gas engine drive at the bend of the L. The pump impeller is placed toward the bottom of the vertical leg. When additional capacity is required two impellers are placed in tandem. An eyebolt provides a connection so a dragline or crane can easily pick up the outfit and shift it to a new position.

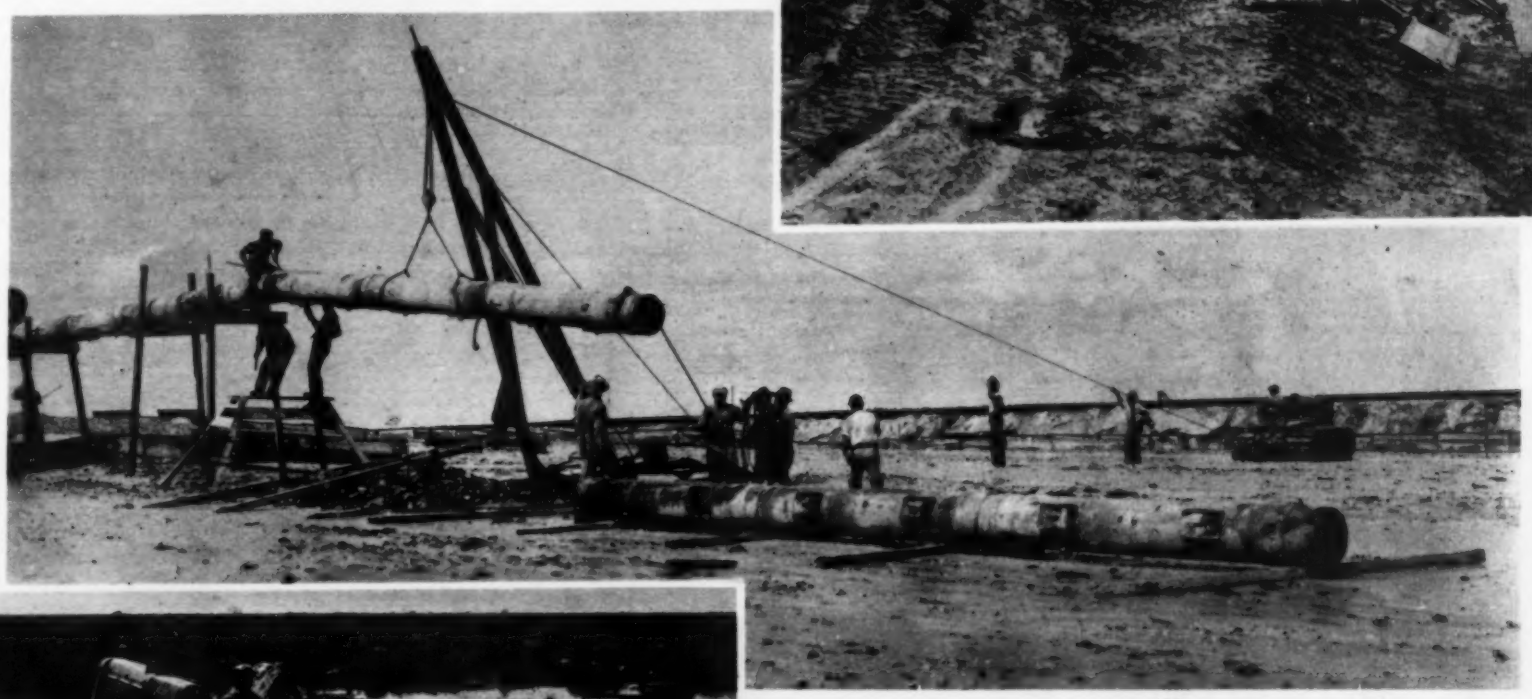
Single impeller units handle 3,000 gal. per minute against a 15-ft. head. Two of these units took care of all the seepage and rainfall from a section of borrow pit about 5,000 ft. long on this job.

Hydraulic Dredging—The Corps of Engineers took over to handle with their own forces and equipment a part of the section of levee which was let to be built by hydraulic dredges. A 20-in. modern suction dredge was brought in to do this part of the job. From the results obtained with this dredge it appears that the entire levee project might have been built to advantage with hydraulic dredges.

In advance of the hydraulic dredge low dikes are built up along both toes of the main levee fill. With these dikes and with careful setting of stop boards, it has been possible to place the levee section remarkably close to the slope required for that type of construction, and with very little loss of the total material pumped. Practically no re-



HYDRAULIC DREDGE *(right)* places pumped material in levee. Retaining wall at right and proper use of stop boards produce almost exact finished levee slopes.



DISCHARGE PIPE from hydraulic dredge is assembled in three-length sections hoisted to place with A-frame on skids. Crawler tractor handles hoist line.

CRAWLER TRACTOR moves stop boards on hydraulic fill levee work by means of sled. With this outfit small gang easily shifts stop boards to get proper slopes on fill.

handling is necessary on this work.

Personnel—Plans for the Lake Okeechobee flood control works were prepared by the Corps of Engineers, United States Army, and are being executed under the direct supervision of that organization. Major General Edward M. Markham is chief of engineers, and Major B. C. Dunn is engineer of the district with headquarters at Jacksonville, with First Lieut. P. A. Feringa and Second Lieut. George Kumpe as military assistants in that office. Carawan Nelson is engineer in general charge of the project, with C. C. Schrontz and Perry M. Teeple, associate engineers, and Raymond C. Baird and E. F. Tippetts, assistant engineers. First Lieut. N. L. Hemenway is resident engineer on the project, having associated with him J. W. Moore, engineer, and E W. Digges, assistant engineer. and First Lieut. R. Selee and Second Lieut. K. E. Fields, of the Corps of Engineers.

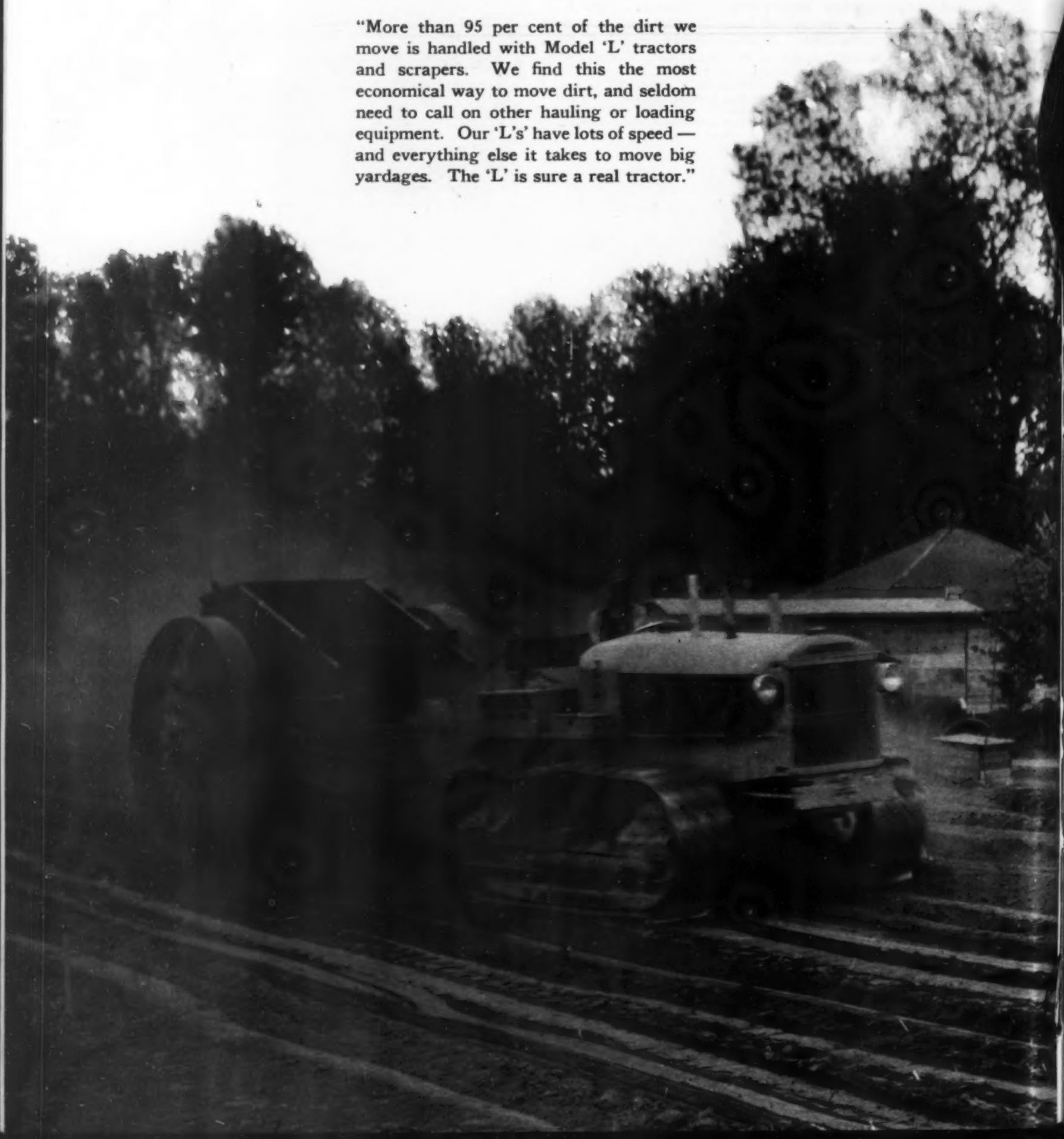
George B. Hills, of Hills & Youngberg, consulting engineers for the Okeechobee Flood Control District, has been associated with the project in that capacity since its inception.

BUILDING UP retaining dikes *(below)* for hydraulic dredge levee construction with small dragline.

"95% with 'L's' and Scra

SAID WILLIAM LATHERS JR.

"More than 95 per cent of the dirt we move is handled with Model 'L' tractors and scrapers. We find this the most economical way to move dirt, and seldom need to call on other hauling or loading equipment. Our 'L's' have lots of speed — and everything else it takes to move big yardages. The 'L' is sure a real tractor."



Scrapers"

Quick Trips

For three years, William Lathers Jr. has been moving dirt with Model "L's" and scrapers on Wisconsin and Illinois contracts. No need for trucks on a job of his . . . high speed Model "L's" move dirt faster and at lower cost than any other equipment.

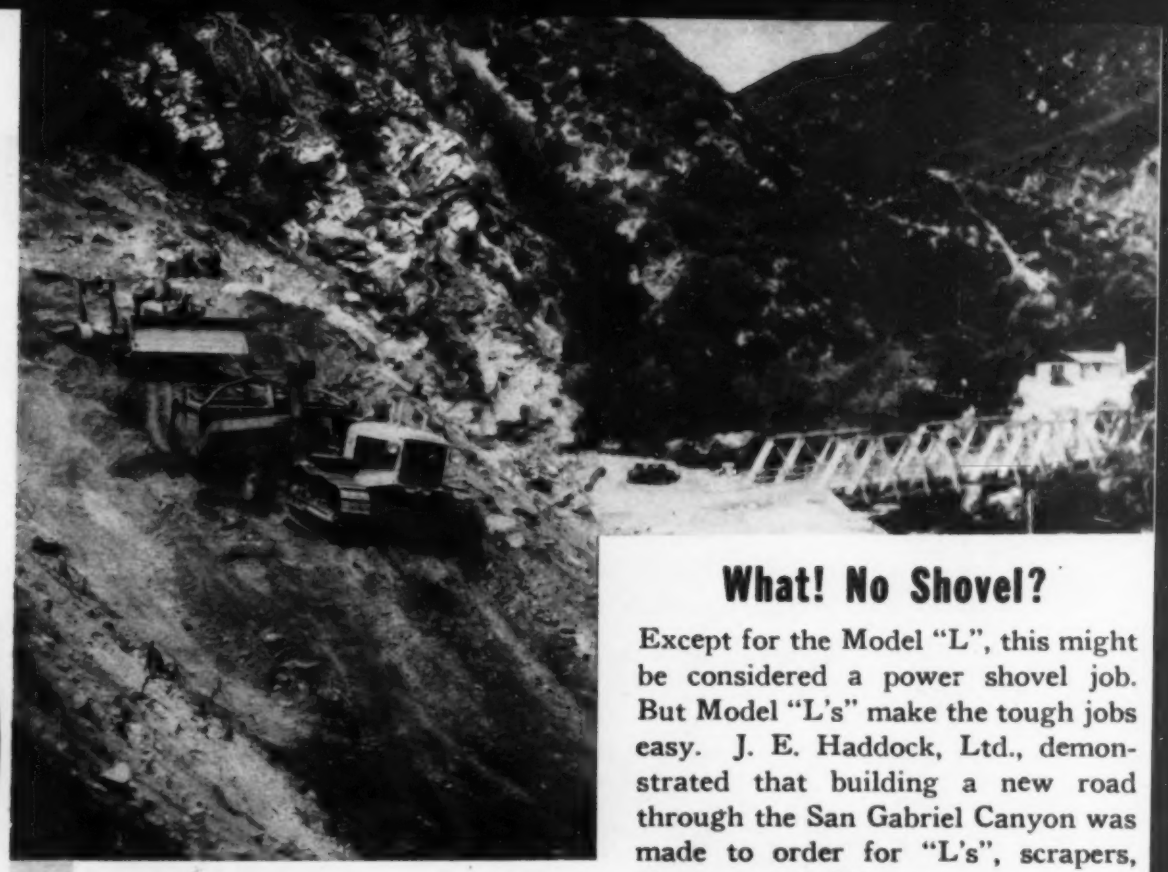
• • •

In the Black Again

"Some of the most commonly used methods of moving dirt are actually the most expensive," said one contractor. "I went broke moving dirt the old way. Now I'm in the black again — Model 'L's' and scrapers have been a life-saver for me." . . . Let an Allis-Chalmers dealer figure with you on more efficient, lower cost dirt moving. He can supply all your equipment needs — track-type tractors, wheel-type tractors, power controlled graders, hand controlled graders, elevating graders, Speed Patrol graders, power units, track wagons, wagon tracks.

You will like the Action Magazine. Write for your copy.

ALLIS-CHALMERS
TRACTOR DIVISION—MILWAUKEE, U. S. A.

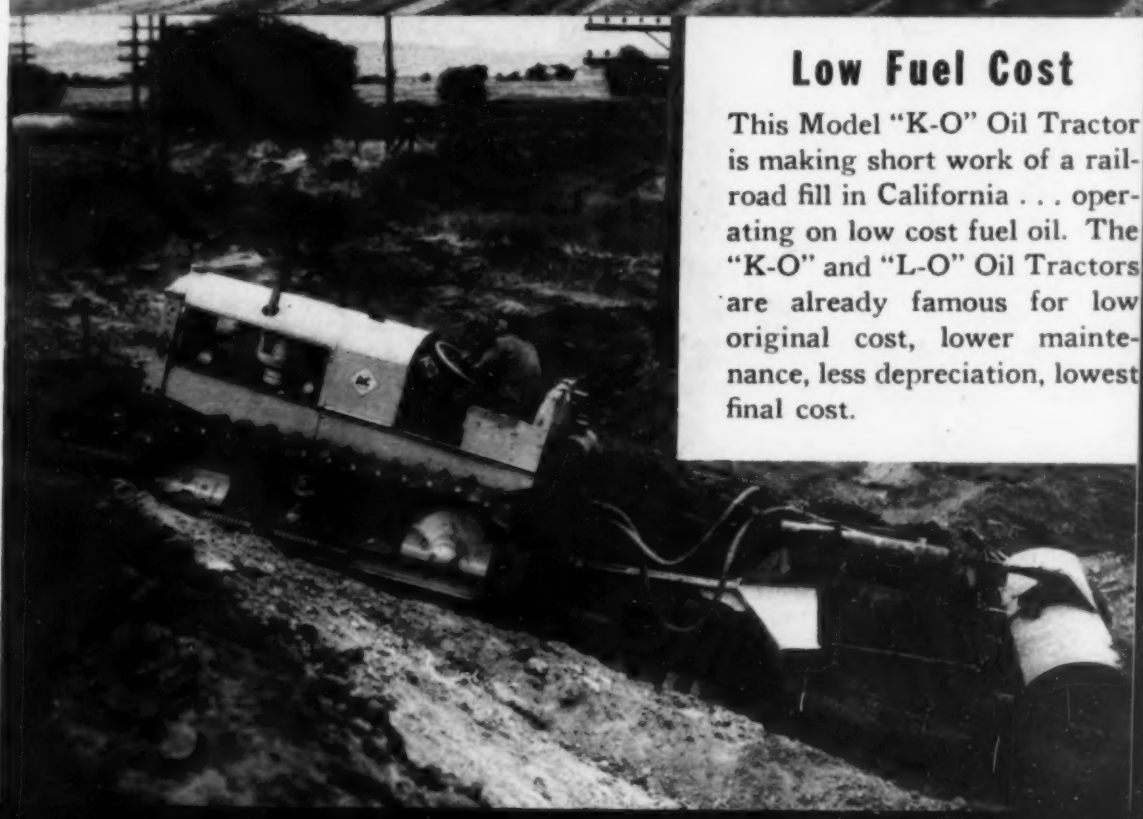


What! No Shovel?

Except for the Model "L", this might be considered a power shovel job. But Model "L's" make the tough jobs easy. J. E. Haddock, Ltd., demonstrated that building a new road through the San Gabriel Canyon was made to order for "L's", scrapers, rippers and bulldozers.

Real Performance

"Model 'L's' for me every time," said the contractor on this job. "They're the only tractor for high speed scraper work — the way we like to move dirt. We push them hard but they give wonderful service. Our boys like the way they perform."



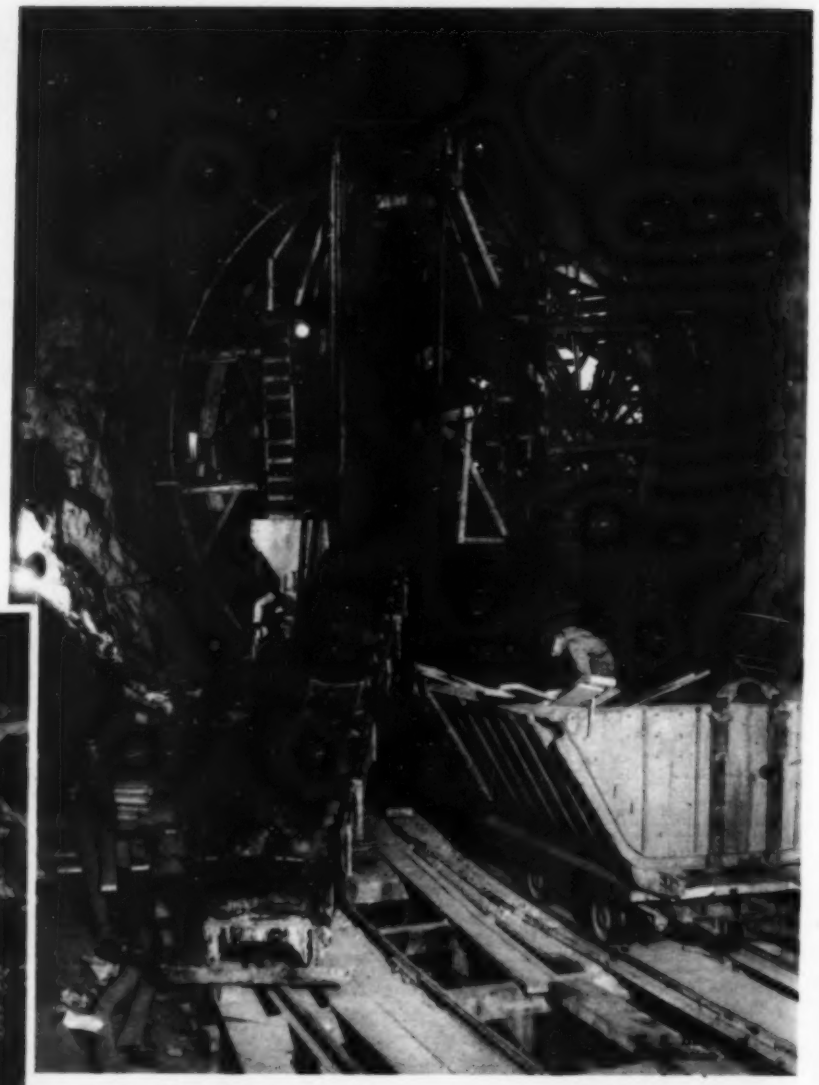
Low Fuel Cost

This Model "K-O" Oil Tractor is making short work of a railroad fill in California . . . operating on low cost fuel oil. The "K-O" and "L-O" Oil Tractors are already famous for low original cost, lower maintenance, less depreciation, lowest final cost.

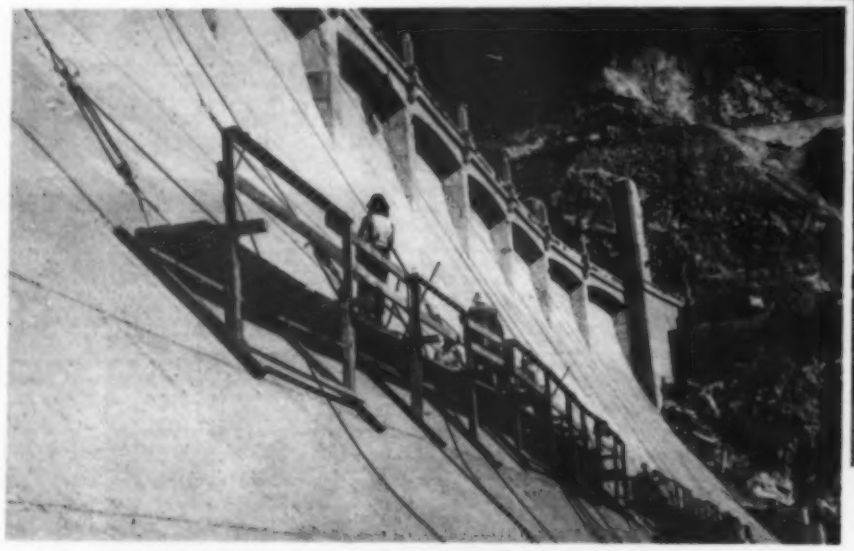
Getting Down to

DETAILS

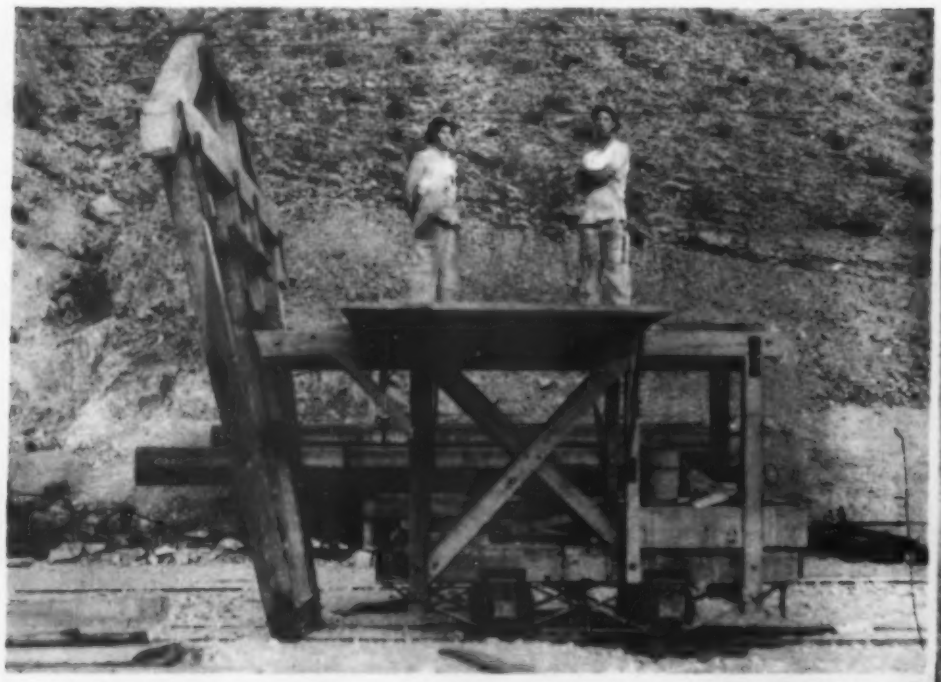
Close-up Shots of
Job Methods and Equipment

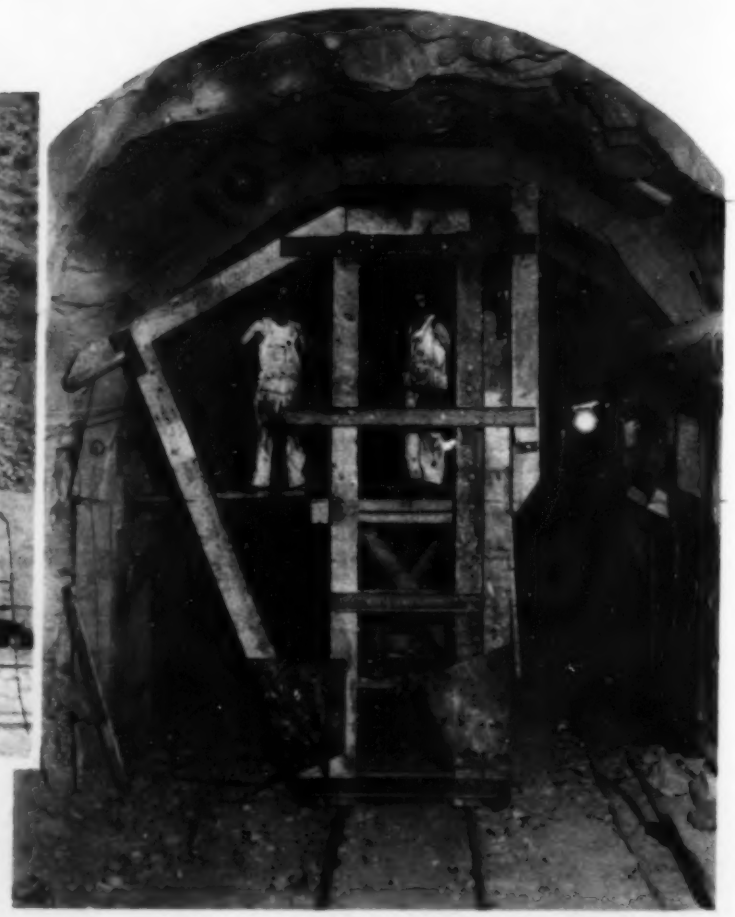


STEEL JUMBO FORM aids placing of concrete lining in Nevada penstock header tunnel at Boulder dam. Belt conveyor delivers mix to sides and bottom of lining while concrete for the top arch is placed by pressure gun.

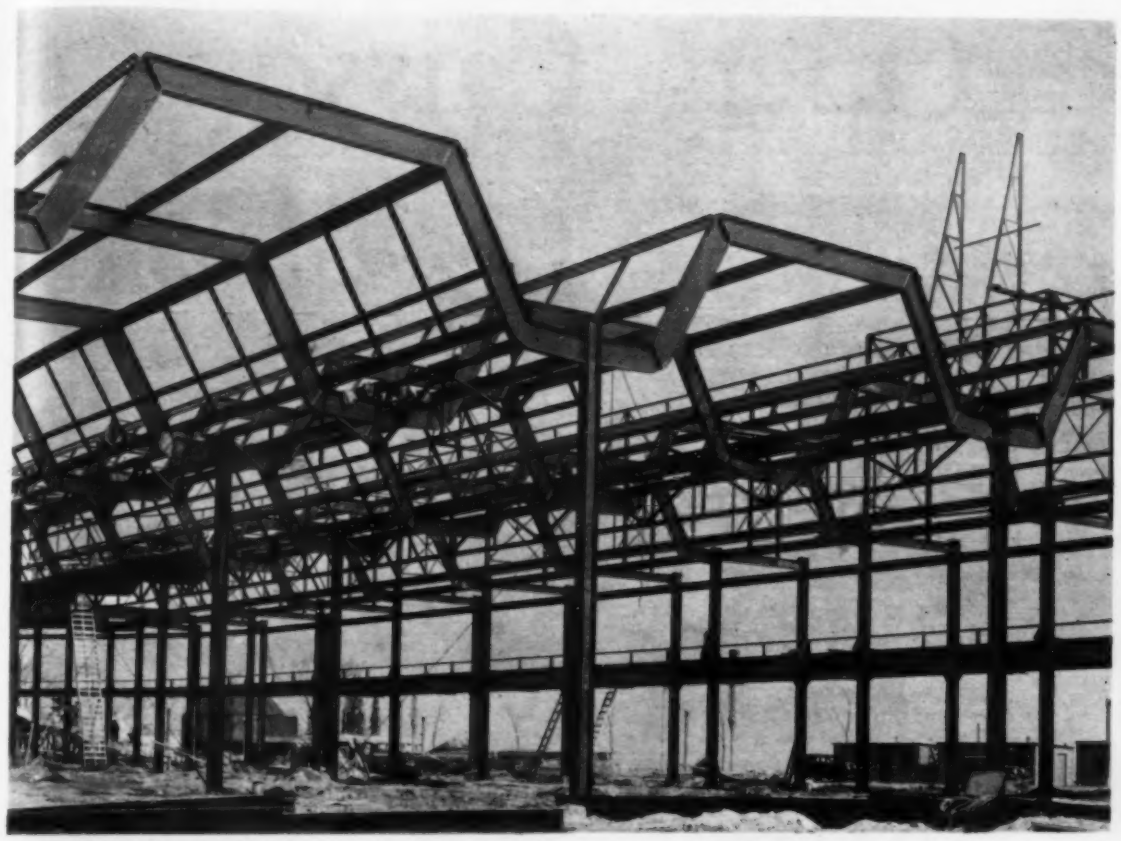


SPECIAL SCAFFOLDS support workers washing face of Morris (formerly called Pine Canyon) dam recently completed for Water Department of Pasadena, Calif. Wire brushes are applied to remove loose concrete and give face of structure smooth, clean surface. Dam is 245 ft. high, 780 ft. long on crest and was built by Bent Bros., Winston Bros. Co. and Wm. C. Crowell.

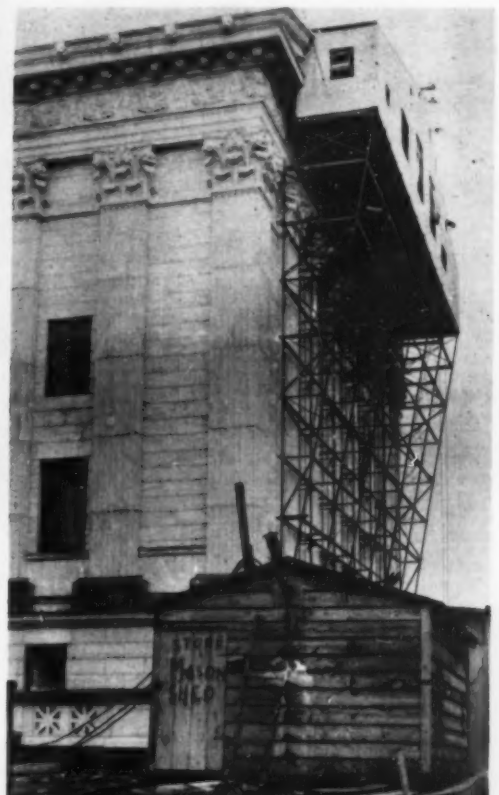




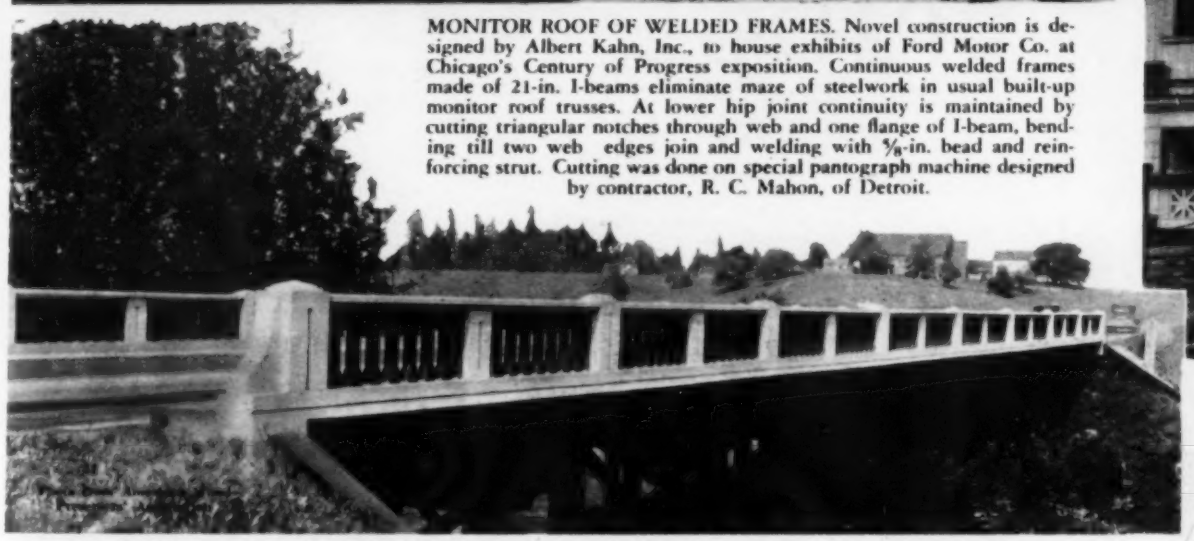
TIMBER CARRIAGE *(above and at right)* devised by C. J. Kavanagh, superintendent, aids tunneling work and prevents accidents in Pushawalla headings of Metropolitan Water District of Southern California's East Coachella bore for Colorado River Aqueduct. Folding mandrel mounted on 4-wheel carriage *(above)* leans inward toward tunnel face when extended and protects workers by supporting freshly blasted rock while standard timber set is installed. Photo at right shows carriage with one wing extended and the other folded up.



STEEL SCAFFOLD (*below*) with battered outside posts supports inclosed working platforms for stone cutters carving pediment of Supreme Court Building, Washington, D. C. Design by J. G. Bent, engineer for George A. Fuller Co., general contractor, allowed all work on steps and other points to proceed without interruption.

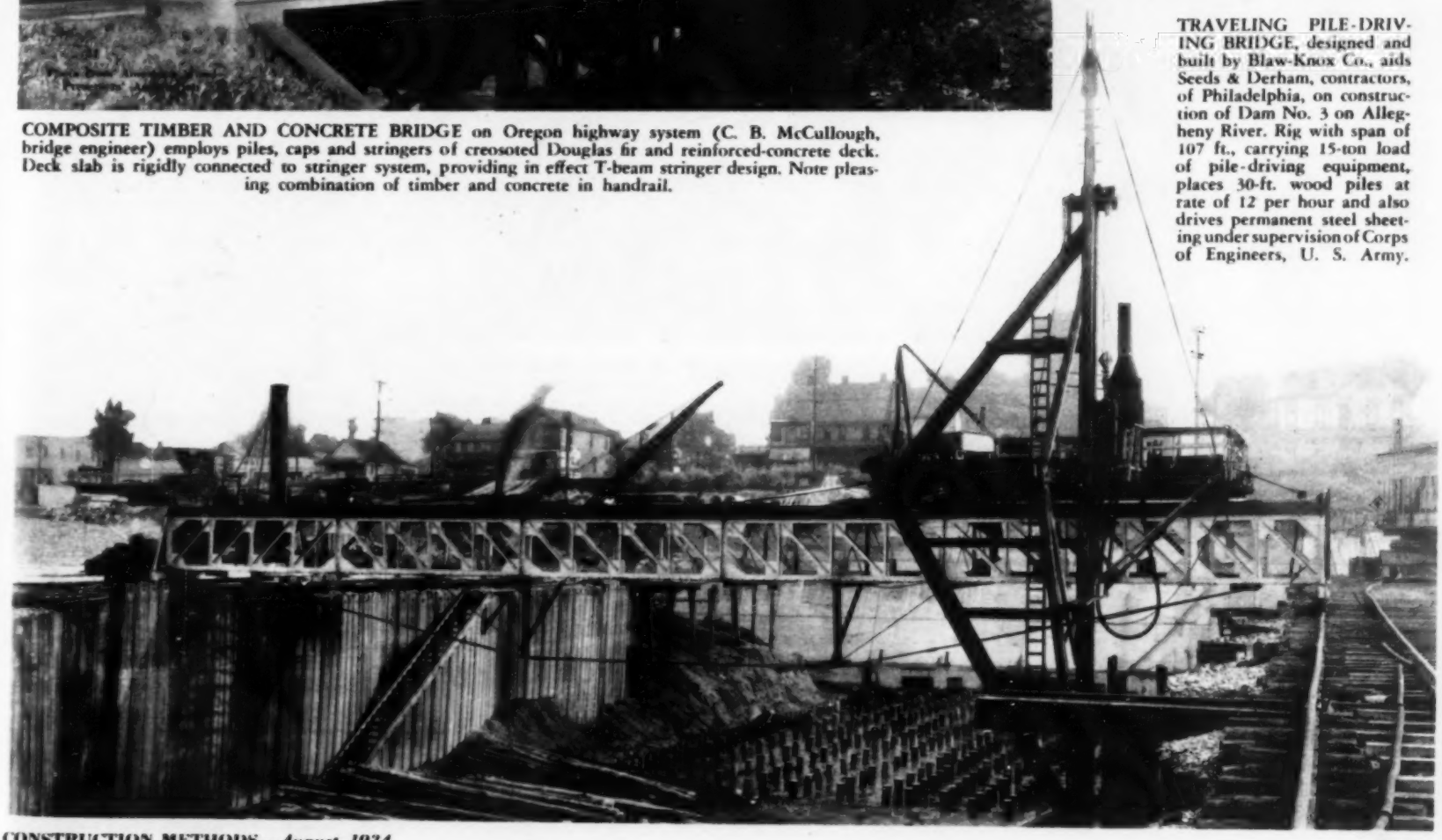


MONITOR ROOF OF WELDED FRAMES. Novel construction is designed by Albert Kahn, Inc., to house exhibits of Ford Motor Co. at Chicago's Century of Progress exposition. Continuous welded frames made of 21-in. I-beams eliminate maze of steelwork in usual built-up monitor roof trusses. At lower hip joint continuity is maintained by cutting triangular notches through web and one flange of I-beam, bending till two web edges join and welding with ⅝-in. bead and reinforcing strut. Cutting was done on special pantograph machine designed by contractor, R. C. Mahon, of Detroit.



COMPOSITE TIMBER AND CONCRETE BRIDGE on Oregon highway system (C. B. McCullough, bridge engineer) employs piles, caps and stringers of creosoted Douglas fir and reinforced-concrete deck. Deck slab is rigidly connected to stringer system, providing in effect T-beam stringer design. Note pleasing combination of timber and concrete in handrail.

TRAVELING PILE-DRIVING BRIDGE, designed and built by Blaw-Knox Co., aids Seeds & Derham, contractors, of Philadelphia, on construction of Dam No. 3 on Allegheny River. Rig with span of 107 ft., carrying 15-ton load of pile-driving equipment, places 30-ft. wood piles at rate of 12 per hour and also drives permanent steel sheeting under supervision of Corps of Engineers, U. S. Army.

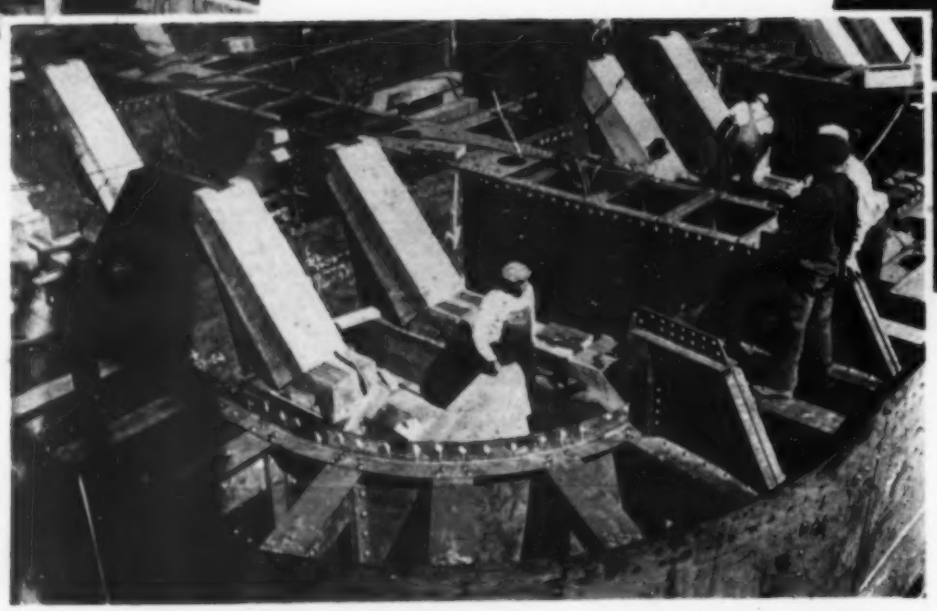


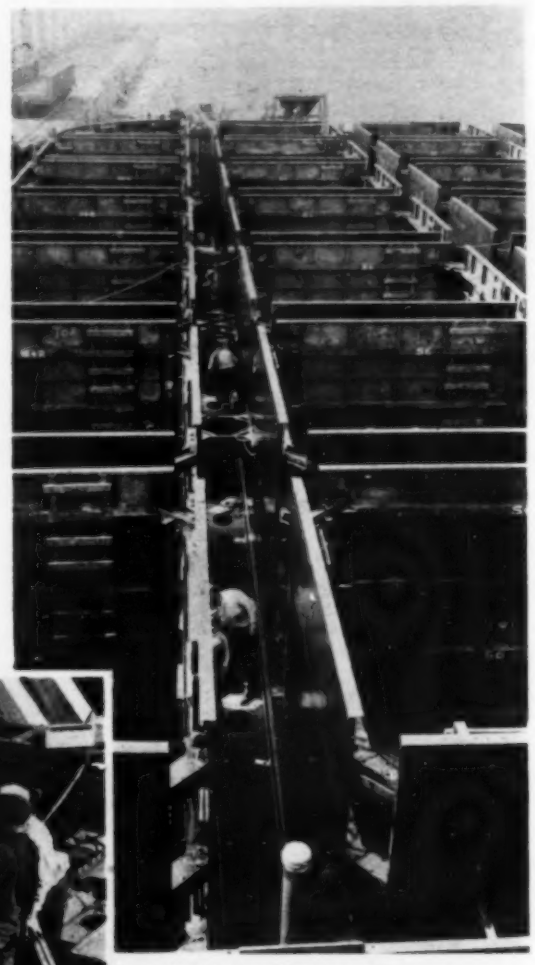
Dredged Open Caissons

Carry Concrete Foundations to El.-235 at East Crossing of

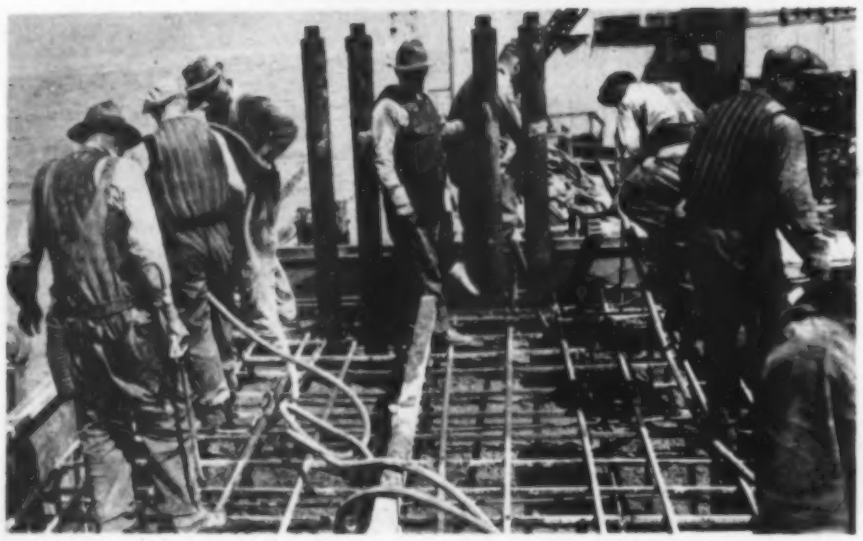
BAY BRIDGE

PLACING TREMIE SEAL *(above)* in bottom of pier 22. Floating equipment delivers concrete to hopper which feeds three 12-in. tremie pipes. Tremies deliver into each bay successively, always keeping delivery end buried in fresh concrete.





AFTER LAUNCHING, cutting edge is built up with forms for concrete that will make it sink. Concrete is poured in walls first and wells are kept open for dredging. Later, wells also are filled with concrete to 30 ft. above cutting edge.

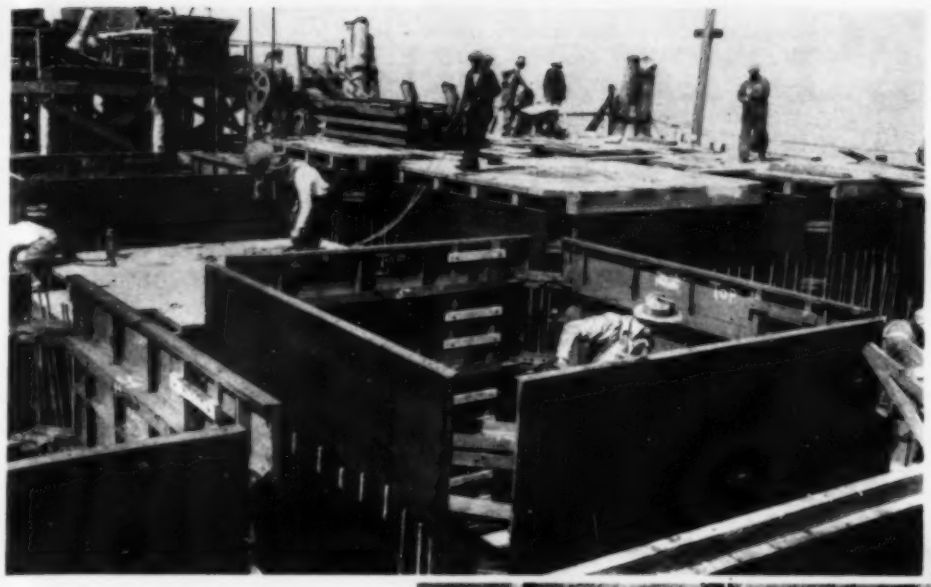


PLACING FALSE BOTTOM TIMBERS. Main timber, 20 in. square, slides against a zinc plate when being removed.

LIFE PRESERVERS *(left)* are worn by all workmen on this contract, including foremen and superintendents. Some wear 'em underneath, but all have them on.

THAT PORTION of the San Francisco-Oakland Bridge which lies on the east side of Yerba Buena Island called for a variety of methods in building the 22 piers of the substructure. Three of the piers were built with the aid of cellular caissons having false bottoms which were pulled out after the caissons had been floated to place and landed on the bay bottom. The remaining nineteen piers include one placed in an open cofferdam on rock and seventeen built in cofferdams, in the bottoms of which wood piles were driven with subaqueous hammers.

Caisson Piers—In all of the open-caisson piers the bottoms were inspected by diver before the concrete seal was placed, despite the fact that in one the



AFTER EACH POUR of concrete *(left)*, another 12-ft. tier of forms is placed, and this process continues as caisson sinks.

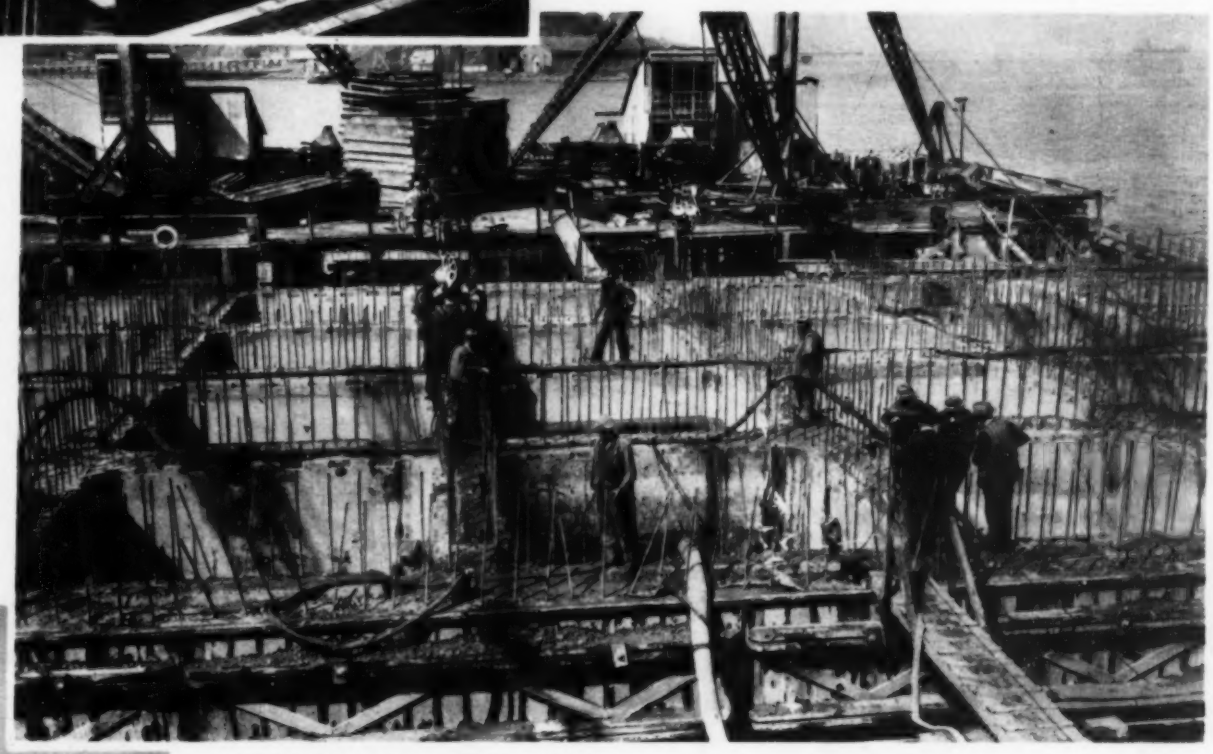
FALSE BOTTOMS *(below)* have been removed, and concrete walls are carried upward as caisson is dredged down into mud.

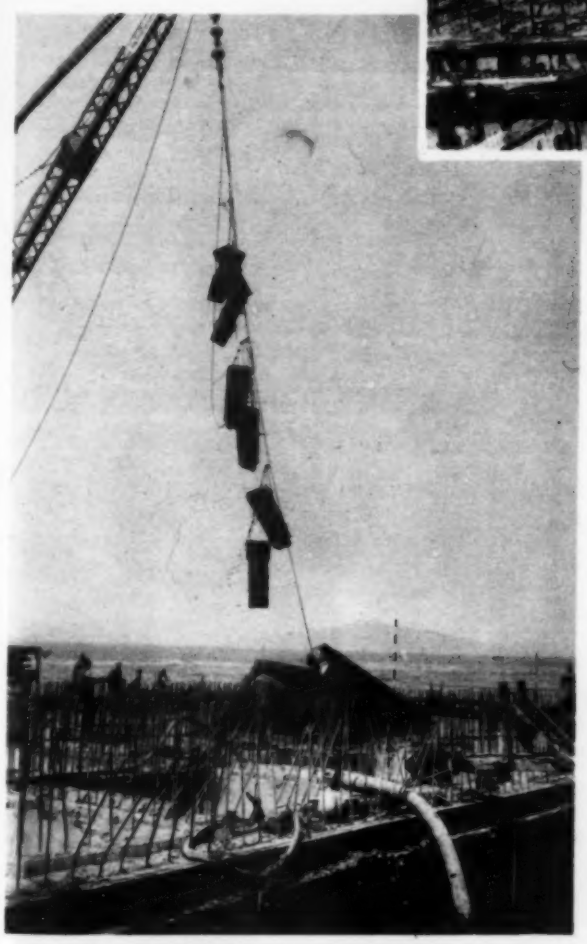
first concrete went in at El. -235. The large caissons are made up of a steel cutting edge and an upper portion of concrete, built up in 12-ft. lifts as the caisson sank into place. Steel cutting edges were built up on shipways, timber false bottoms were put in the dredging wells, each 15 ft. square, and the cutting edge then was floated to place. The sides and inner partitions between wells were built up as the caisson was sunk by the weight of concrete.

When the cutting edge was so well down in the mud that the caisson would sink no farther of its own weight at the desired rate, the false bottoms were removed by pulling on cables left for that purpose in the collapsible bracing system. In this way the bottoms of the dredging wells, successively, were opened admitting mud and water into each well.

Dredging from these wells facilitated further sinking of the caisson into the desired position. By equalizing the amount of dredging from the various wells, the sides of the caisson were kept plumb during sinking, until the cutting edge reached the specified level, when a final jetting cleaned out each of the dredging wells. Pumps removed the slurry resulting from this jetting. After the bottom had been inspected by a diver, concrete was placed with 2-cu.-yd. bottom-dump buckets. The maximum foundation loading in the deep caissons was 2½ tons per square foot in excess of the load carried by the foundation stratum before being disturbed by construction.

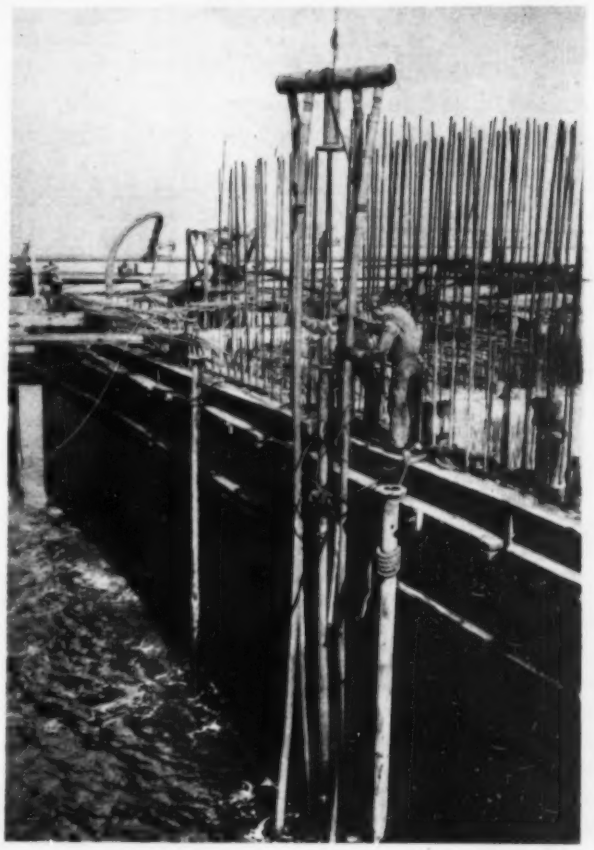
In the largest of the caissons, E-3, 80x134 ft. in plan, were 28 dredging wells approximately 15 ft. square, with outside and inside concrete wall thicknesses of 4 ft. and 3 ft. respectively. Each of the two other caissons, 60x90 ft. in plan, had fifteen dredging wells with similar wall thicknesses. All three caissons were placed with great accuracy. The final cutting edge of E-5 was within 3 in. and of E-4 within 1 in. of designed location. The rate of sinking in putting down the caisson cutting edges averaged 1.8 ft. per calendar day





PULL OF CABLE effectively removes false bottoms. Heavy bracing timbers are seen above and below are two sections of false bottom proper.

ASSEMBLING JET PIPES *(right)* which are used inside caisson. Water is supplied to jet manifolds under pressure in four fire hoses, as these are easier to handle than large metal pipe. Pump for slurry excavation is shown in background.



UNDERNEATH CUTTING EDGE *(left)* **on caisson E-4. Note jet pipes, indicated by arrow, used to loosen material around cutting edge. Timbers of false bottom appear at top.**

on E-3, 1.08 ft. on E-4 and 1.13 ft. on E-5.

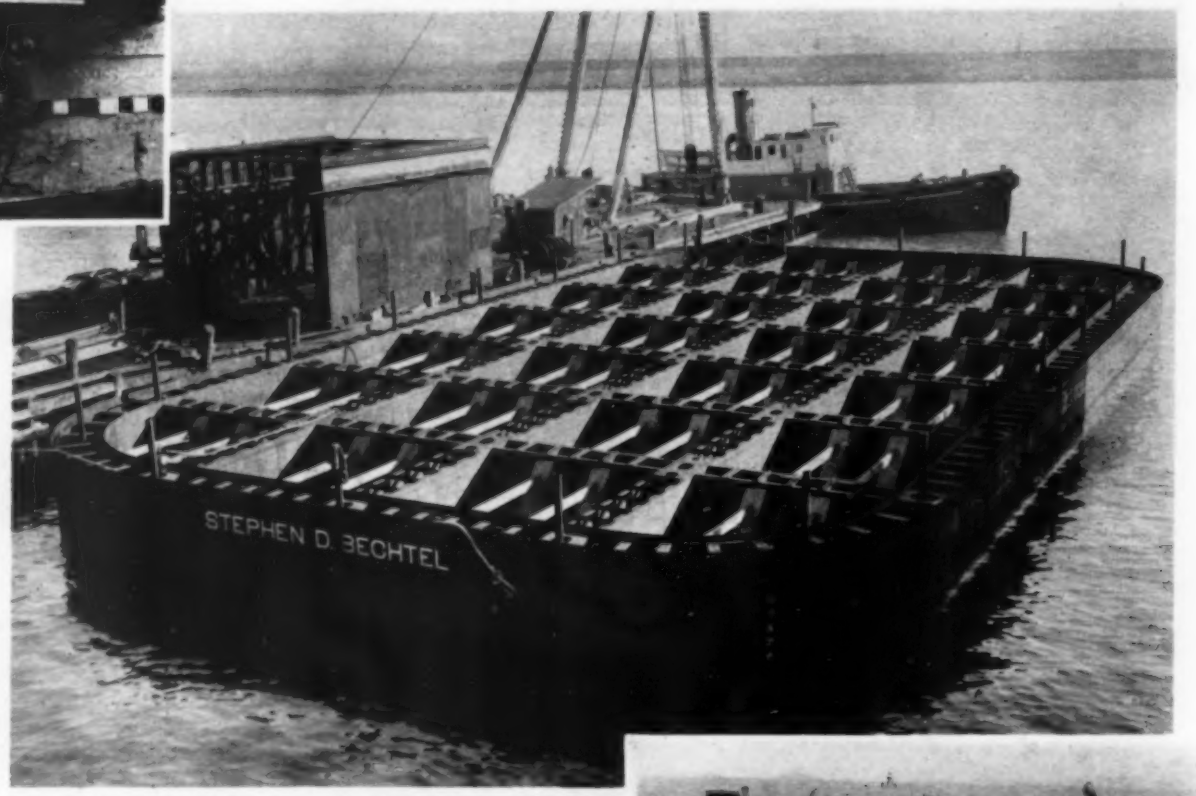
Cofferdam Piers — Pile foundations under the piers built within steel-sheet-pile cofferdams are intended more to increase stability of the piers in case of earthquake than to increase the bearing power of the foundation stratum. In beginning construction at the site of a pile pier, excavation first is carried to El. -30, and steel sheetpiling then is driven with master piles spaced by a guide frame. After excavation has been completed, piles on 4-ft. centers are driven with a McKiernan-Terry 10B3 subaqueous hammer. When the piling is in place the bottom is cleaned by pumping and is inspected by the state diver to make sure that the cleaning is complete and that all broomed pile heads are cut off. A gravel blanket 5 ft. thick then is dumped by grab buckets and the concrete seal is placed with the aid of tremies supported by a gantry to which concrete is delivered from floating mixing equipment.

A piledriver was designed specially for this work. Its leads are mounted on a turntable supported on two transfer tables, enabling it to move horizontally in either direction. The leads are telescopic for about 40 ft. of their length and have a shaft mounting near the lower end by which they can be inclined backward to facilitate driving the batter piles which are inclined outward under the edge of the cofferdam. Piles are driven to a level of El. -115 with an average of 100 blows for the last foot.

Other major items of equipment are four stationary stiff-leg derricks used at piers E-3, E-4 and E-5, each equipped with 150-hp. motor-driven three-drum hoists and 100-ft. booms having a capacity of 21 tons at 60-ft. radius or 13 tons at 90-ft. radius; two whirley cranes, each on a 40x64-ft. barge with 65-hp. boiler, operated by three-drum hoists and equipped with 85-ft. booms designed to lift 20 tons at 30-ft. radius or 7 tons at 75-ft. radius; two floating stiff-leg derricks with 60-hp. boilers, three-drum hoists, 100-ft. booms-capacity, 10 tons at 60-ft. radius or 6 tons at 90-ft. radius; one pile-pulling barge, 96x34 ft., with A-frame 100 ft. high, two eight-sheave blocks (24 in. and 30 in. in diameter), 16-part plow-steel line, 50-hp. engine, four-drum hoist, 150 ton capacity.

By the middle of June twelve of the seventeen pile piers were complete and the caisson piers E-4 and E-5 were complete. All piers for this crossing are expected to be completed in the late fall.

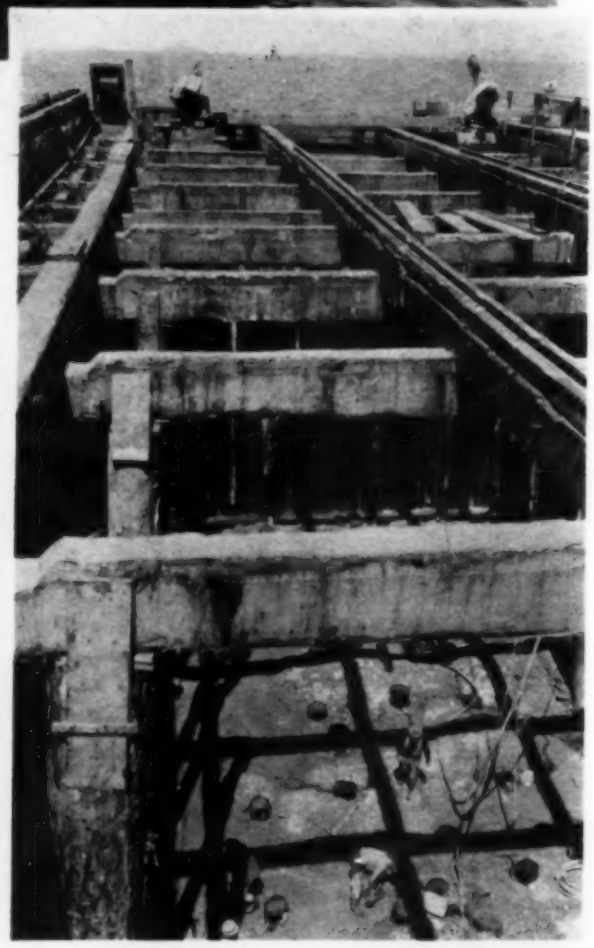
The contract for this work is held by Bridge Builders, Inc. H. J. Kaiser is president, E. H. Connor, managing engineer and C. B. Jansen, superintendent. C. H. Purcell is chief engineer of the San Francisco-Oakland Bay Bridge, and Chas. E. Andrew, Glenn B. Woodruff and V. A. Endersby are bridge engineer, engineer of design and resident engineer, respectively.



CUTTING EDGE *(above)* **for caisson E-5 after launching, showing 28 15x15-ft. dredging wells. Note false bottom bracing in place; also pipes for jetting around edge.**

LOOKING DOWN *(right)* **on freshly unwatered seal top in pier E-16. Note projecting pile heads. Laitance is being cleaned off prior to pouring concrete footing.**

(Left to right) **C. B. JANSEN, superintendent, Bridge Builders, Inc.; V. A. ENDERSBY, resident engineer for state; C. H. PURCELL, chief engineer, and C. E. ANDREW, engineer of design, San Francisco-Oakland Bay bridge.**

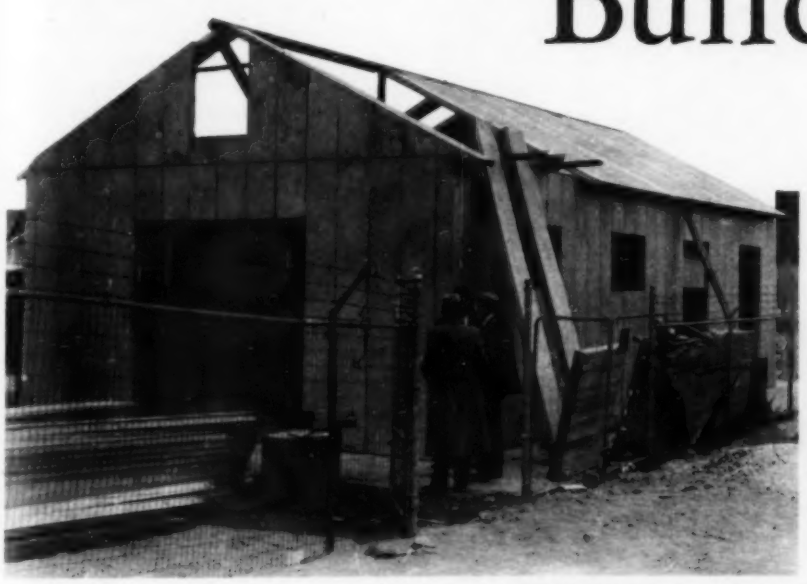


Standard Panel Unit

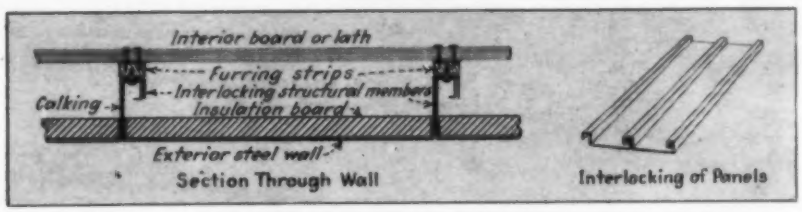
Simplifies Erection of

Steel Farm Buildings

THE HOME of the American Milk Goat Record Association at the World's Fair will be an insulated, fireproof, steel farm building built to demonstrate a new interlocking, self-framing system of construction by the Steelox Co. of Chicago, in cooperation with the American Rolling Mill Co., the Celotex Co. and Sears Roebuck & Co. This method eliminating all rafters, studs and joists, is applicable to various types of farm buildings, commercial buildings and other structures where economy of construction and maintenance is essential. Buildings of this construction may be taken apart, moved and erected again.



INTERLOCKING CONSTRUCTION *(two photos above)*, **using standard channel-shaped panels, 16 in. wide and 3 in. deep, with flanged sides, eliminates rafters, studs and joists.**



DETAILS of panel unit, showing interlocking feature and method of insulation with fiber board.

With the object of simplification one typical unit is used to make the walls, partitions, roof, and even the floor. This unit is a channel-shaped panel, 16 in. wide and 3 in. deep, with flanged sides so the flange of one panel slips into the flange of the adjoining panel. The sides, or legs, of the interlocked panels serve as structural members, while the bottom of the channel acts as a web for bracing the interlocked members. When interlocked in the wall, the average weight per square foot is 2¼ lb. All of the panels come to the job insulated with 1 in. of fiber board held in place with a special adhesive. This insulation also sound deadens the structure. Where it is desired to finish the interior walls, the panels have a furring strip attached to the flange. Not only does this serve as a nailing strip, but it also destroys thermal conductivity through the interlocked members.

Ordinarily, the interlocked panels are erected with the smooth side of the wall to the weather. However, if desired, the steel ribs, formed by the interlocked members, may be turned to the exterior, providing a smooth wall inside. When additional strength either as a column or a beam is necessary, the panels may be made deeper or of a heavier gage steel. The barn erected at the Fair is made of 20-gage galvanized Armco ingot iron. If desired, the panels may be furnished with a permanent porcelain enameled surface.

Field Erection—Field assembly was simple and required no special equipment or skill. A channel of 14-gage ingot iron was bolted to the foundation. Then a corner panel—a typical panel bent longitudinally at right angles—was set in place. The wall panels were then quickly interlocked. Short panels were inserted where door or window openings occurred. A hook bolt secured the interlocked members to the foundation channel. Heavy gage angles were used as top plates at the roof line and to them the tops of the panels were fastened with hook bolts. The angles used on the sides were folded over on the same pitch as the roof, to receive the roof panels.

The same typical panel forms the roof. A specially designed self-supporting ridge, with a short protruding flange on either side to receive the roof members, was set in place. Then the roof panels were passed up and interlocked. Since all the roof units were of the same length, it was only necessary to align them at the eaves. Joints between all panels were sealed with "stikum", a waterproof calking material. The roof panels were secured with hook bolts to the ridge and to the top plate on the wall.

After the roof members were in place, the panels were placed in the gable ends. Specially formed galvanized sheets were used for trim and drip boards.

The structure required but little bracing. V-shaped purlins were attached to the ribs midway of the roof members and connected with light steel rods. A short diagonal rod connected the purlin with the corner.

As the building was constructed on a concrete slab, Steelox panels were used as flooring only in one bay over an office to provide a loft for storing materials.

The American Rolling Mill Co. supplied all the sheet metal; Celotex furnished the insulation board; Sears Roebuck, the doors, windows and ventilators; and Paint Products Laboratories the adhesive and calking. The barn is located near the south end of the World's Fair grounds, and is a part of the Poultry and Farm Group.

ROCK-FILL COFFER

Incloses Portion of Wheeler Dam

POWER-HOUSE COFFERDAM inclosing area of 14 acres is ordinary Ohio River wood-box type consisting of two walls of plank sheeting filled in between with earth. Coffer is practically watertight, all seepage being removed by few small pumps.

UNWATERING of the second section of the cofferdam for the Wheeler Dam of the Tennessee Valley Authority on the Tennessee River, 16 mi. upstream from Wilson Dam at Muscle Shoals, was completed in 15 hr. on June 29, about two months after construction of this portion began. This 200x1,200-ft. cofferdam incloses the site of the first section of the dam and connects with a 400x1,400-ft. cofferdam that was built to inclose the site of the power house, extending out from the left, or south, bank of the stream.

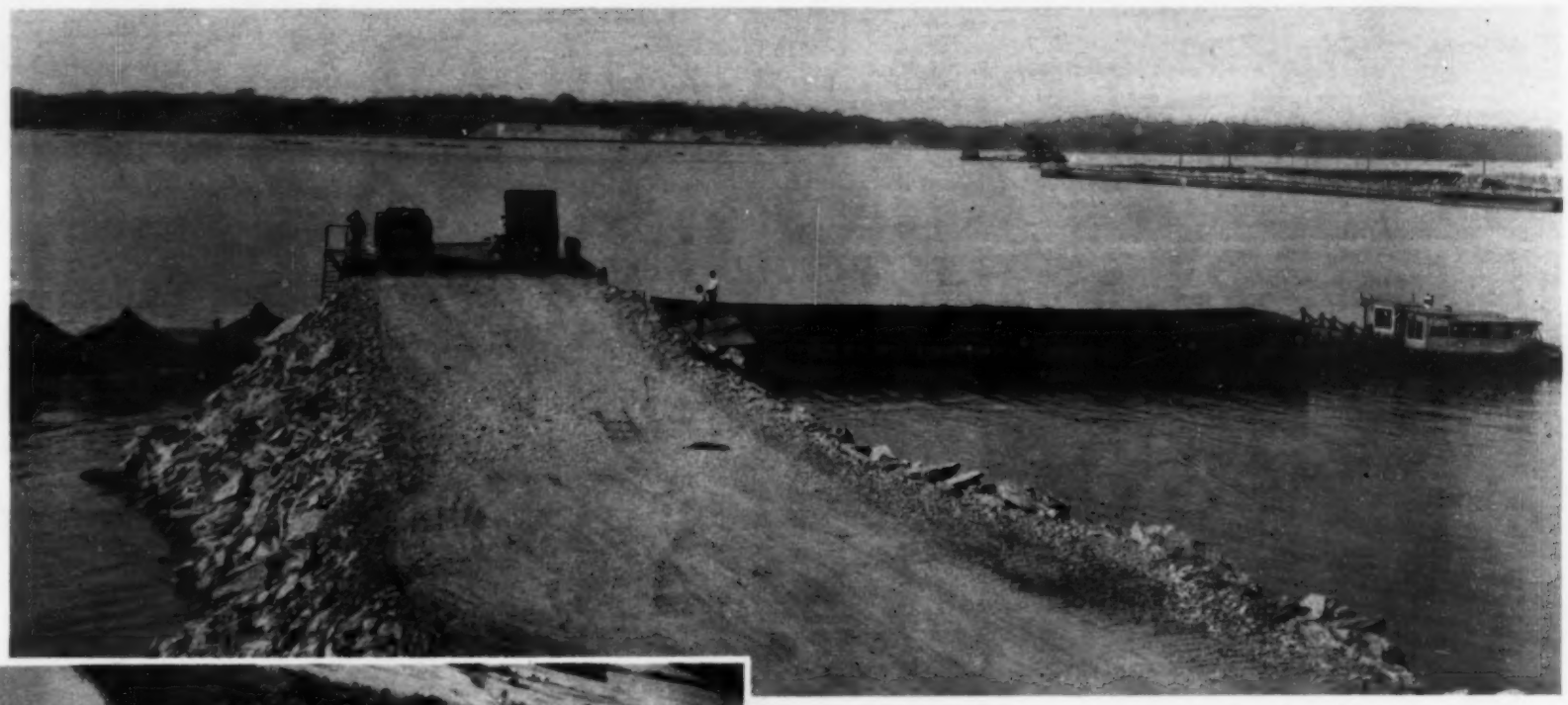
At this location the Tennesseee has a total width of about 6,600 ft. At the north end of the project a lock is just being completed, as described in Construction Methods, Feb. 1934, pp. 24-25. Removal of the 300,000 yd. of rock required in preparing the site for the power house at the other end was about 75 per cent completed when these notes were written.

Ordinary Ohio-River-type double-walled wooden construction filled with earth was used in building the power-house cofferdam, inclosing more than 14 acres. When unwatered it proved exceptionally tight, the seepage being handled easily by a few small pumps.

Rock-Fill Cofferdam—According to the initial plans for the project, all material from the power-house excavation was to be wasted. After this phase of the job got under way, however, it was decided to use the rock spoil from the excavation in the walls of the second cofferdam. To obtain watertightness a blanket of clay was placed on all outer faces of the loose-rock fill. This blanket was sloped and covered with close plank sheathing on which was placed a

WHEELER DAM under construction. Against near bank is 400x1,400-ft. cofferdam inclosing site of power house. Extending outstream from this coffer, second section is being built. Across river against other bank practically completed lock may be seen.

FLOATING DERRICK *(left)* — only steam equipment on job—unloads soil from barges to place on stream side of first lift of rock fill for second coffer.



WIDE ROADWAY extends out to trap through which trucks dump soil for cofferdam blanket into barges.

LOCK CONSTRUCTION, involving 30,000 yd. of rock excavation and 70,000 yd. of concrete, proceeds to completion inside steel sheetpile cofferdam on north bank of Tennessee River.

layer of rock to take wave action.

Spoil from the power-house rock excavation was handled in White trucks equipped with 10-yd. steel dump bodies. To reach the fills for the second cofferdam these trucks ran up ramps to the top of the power-house cofferdam, in some cases on grades of 15 per cent. The rock fills for the second cofferdam were made by the trucks dumping directly into place. When the haul became too long for the trucks to back out over the fill, a spur fill was built up inside the wall to provide a turnaround.

Clay Blanket—Material for the clay blanket on the water side of the rock fill was obtained from a heavy highway cut required by improvements on the south shore of the project. This spoil, which was an excellent gravelly clay, was delivered in dump trucks on a ramp filled out from the shore into water deep enough to float barges. The barges moved the spoil to the point where it was to be placed.

Width of the offshore ramp was great enough for a double-track roadway. At its outer end rock-filled cribs were placed to provide a trap through which the dump trucks could discharge directly into the barges. The space at the outer end of the roadway was ample to permit two trucks to maneuver and turn around without interference.

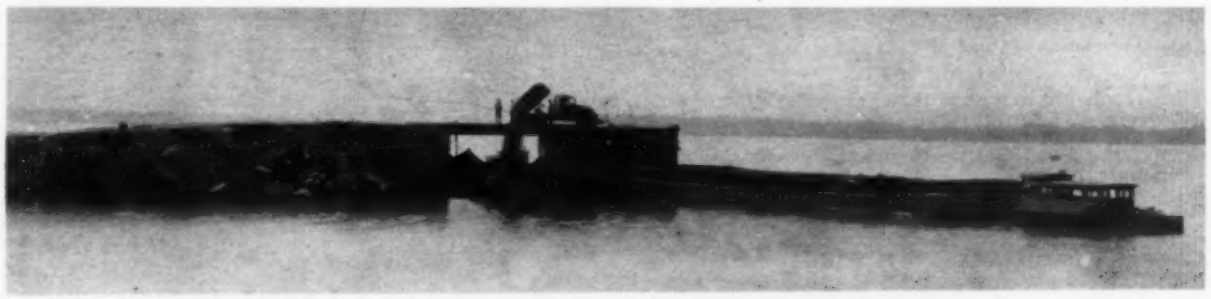
From the barges the soil for the blanket over the rock fill was unloaded by a steam floating derrick, the only steam unit on the entire project, all other equipment being electrically driven or run by air from motor-driven compressors. When the rock fill for the cofferdam had been built to the full height and the soil blanket had been placed, the latter was sloped carefully by hand. The sheathing for the soil blanket had been assembled previously in sections stored nearby in convenient piles. These sections could be set in place rapidly after the slope was ready. The sections of planking were fastened together with battens along both longitudinal and transverse joints to help hold them in place.

Wave Protection—Rock for the riprap cover on the plank surfacing was delivered to the top of the cofferdam fill in trucks from the power-house excavation. The broken rock was placed by hand to assure close setting and prevent later slippage. To avoid too heavy handling for the men, large rock were eliminated at the excavation. Excessive fine-rock spoil also was eliminated from the riprap protection.

In unwatering the cofferdam, three 12-in. and one 6-in centrifugal pumps, all electrically driven, effected a combined rate of discharge of about 14,000 gallons per minute, exposing the river bottom over the entire area in about 15 hr. Before unwatering, the average depth of water inside the cofferdam was 7 ft.

Under ordinary conditions, Wilson Dam creates slack water at the site of Wheeler Dam. With 2,600 ft. of the channel cut off by the two cofferdams now in place, and some further channel reduction on the other side of the river from the cofferdam around the lock, there is considerable building up of water above the cofferdams during flush flows in the river. This condition produces swift currents at times. There also is considerable wave action during heavy winds, which have a sweep of more than 16 mi. upstream from Wilson Dam. No difficulty from scouring due to currents or wave action is expected with the type of cofferdam construction adopted.

A. E. Morgan, chairman of the Tennessee Valley Authority, also is chief engineer of that organization. Carl A. Bock is assistant chief engineer and C. H. Locher is construction consultant on all projects. W. M. Hall is engineer of construction, and Lee Huntley is superintendent of construction on the Wheeler Dam, which is being built with the forces of the Authority.



DUMP TRUCKS trap soil for cofferdam blanket into barges for delivery to floating derrick.

Step-by-Step Field Methods

Low Cost Gravel Roads Improved by DESIGNED STABILIZATION

IN SPITE of the generally wide application of traffic-bound gravel or crushed stone surfaces on a large mileage of county or feeder roads supplementing the primary routes of the state highway systems, the attention and study given this type of construction has been comparatively slight. Now that the low-cost secondary road is assuming increased importance, not only for carrying farm-to-market traffic but also as a base for a later stage of construction of a higher type, an appreciation of the shortcomings of the gravel road, as ordinarily built, has furnished the incentive for developing what are generally referred to as "stabilized" gravel roads, involving a scientifically designed mixture of adequate thickness and a proper control of aggregate, binder and moisture content. In Missouri the State Highway Department has been particularly active in investigating and constructing stabilized gravel roads, and the following notes on its work are from a report presented early this year to the Missouri Highway Engineers Conference and to a similar meeting of state highway engineers in Kansas, by F. V. Reagel, engineer of materials, and R. C. Schappler, geologist, of the Missouri Highway Department.

Basic Theory—To produce a stable sand or gravel base the clay-silt-sand-gravel system must have necessary properties to resist lateral flow when loaded under all weather or climatic conditions. The axiom of soil mechanics that stability depends upon a balanced combination of two soil properties — internal friction and cohesion—is directly applicable to the system of materials under discussion. A surface properly designed and constructed, and taking advantage of all the properties of the various materials necessary to achieve maximum stability, would still tend to dry out and dust, with a consequent loss of material thickness. This amount of dust however, can be controlled by sprinkling with water, by application of hygroscopic salts such as calcium or magnesium chloride or by sprinkling with a sulphite solution of lignin, a waste product of the cellulose industry. The use of calcium chloride, Messrs. Reagel and Schappler state, is the more efficient and practical at the present time and has the particular advantage of furnishing calcium ions for insuring the calcium saturation of the clay binder.

1 BEFORE STABILIZATION, loose-gravel road presents hazards of dust, flying pebbles and skidding and adds to highway cost by rapid loss of material and need of constant maintenance.

4 AFTER SCARIFYING, original material on road is ready for mixing with additional ingredients.

3 SCARIFIER ATTACHMENT on blade grader breaks up existing surface.

Construction Practice—The field procedure for carrying out stabilization of gravel roads in Missouri is described below and illustrated by the accompanying series of photographs showing, in sequence, the several construction operations involved:

An 8-mi.section of a relatively heavily traveled gravel-surfaced road including jobs 5 years and 3 years old was selected for the first work in designed stabilization. The work had the attention and direction of Fred Burggraf of the Technical Committee of the Calcium Chloride Association and was carried on by Division Five maintenance forces. Preliminary sampling and investigation established the fact that the existing mat was less than 1 in. thick and that the subgrade could not be depended upon to furnish the proper binder. Suitable clay was readily available and, by taking into account the amount of lopse gravel in mulch, windrow and stockpile, a quantity sufficient to build a 2-in. mat was determined. Construction opera-

2 FIRST OPERATION of stabilizing process employed in Missouri experiments consists of scarifying existing surface to loosen all available material for designed mixture. Two tractors pull scarifier.

tions consisted of distributing the designed amounts of the clay in a windrow on one side of the road and windrowing the loose gravel to the other side. The clay windrow was bladed uniformly across the roadbed, and following this the gravel windrow was uniformly spread over the clay. Immediately then the base was scarified to a depth of about 2½ in., after which all of the loose material was bladed off in two equal windrows to each side of the road. After reshaping the subgrade, the windrows were moved in and finally mixed and spread by a multiple blade maintainer. Blading and smoothing operations continued during the stage of early compaction under traffic and when properly shaped calcium chloride was spread at the rate of one quarter pound per square yard.

The completed road has been in service for six months and, notwithstanding local irregularities and deficiencies,

5 LOOSENED MATERIAL is windrowed by tractor-drawn blade grader after scarifying.

6 CLAY BINDER for designed mixture is dumped at side of road in required quantity per mile. Clay is kept clear of windrow of loose gravel.

in general the results anticipated were realized. The compacted mat has a satisisfactory, uniform thickness averaging more than 2 in. In the early stages of compaction following rains an excess of binder worked to the surface. This excess has since been dissipated or absorbed. The surface now is dense and remarkably hard in dry weather so that blading can only be performed after a rain while still in a somewhat moist condition. Blading operations are reported to have been reduced seventy-five per cent. The main localized defects consist of pot holes, apparently due to standing water associated with insufficient crown and a longitudinal wavy surface reflecting the shallow grooves of the scarifier teeth or uneven compaction under traffic. Both these defects can be expected to be gradually corrected by reshaping whenever weather and moisture conditions permit.

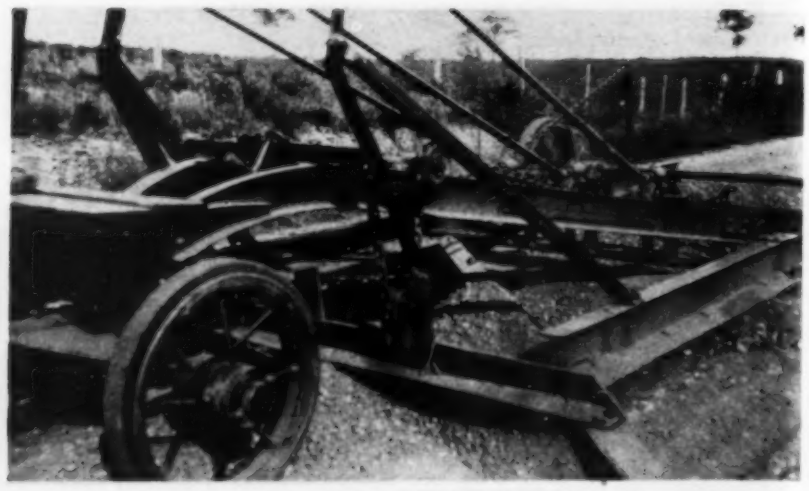
Second Project—The results of the first work attempted in stabilizing an existing gravel road emphasized the fact that, due to variable conditions in the subgrade, the preliminary survey, sampling and testing are not sufficient to design the work finally and satisfactorily. It is conceivable that under conditions where long stretches of the road are determinably uniform, preliminary sampling and testing are sufficient guide for construction. However, in Missouri, such conditions will be relatively rare. Accordingly, on a later job it was recognized that non-uniformity was to be the rule and the following procedure was adopted. The 12-mi. job was sampled as to mat, windrow, subgrade and available material. The materials available included standard surfacing gravel in stockpiles, limestone screenings at a quarry in the locality and clay from several proposed sources. Limestone dust and silt were added to this list when it later became apparent that their

7 CLAY is spread and broken up on subgrade of road. Note gravel windrow at left.

8 ON BLANKET OF SPREAD CLAY *(left)*, limestone screenings are dumped at designed rate per station to supply needed fines.

9 AFTER BLADING SCREENINGS *(right)* uniformly across clay, construction force forms windrow of clay and screenings.

10 GRAVEL, SCREENINGS AND CLAY are mixed thoroughly by blade machines which turn mixture and build it into windrows.



11 FINAL MIXING and uniform spreading of stable mixture are accomplished by multiple-blade maintainer.

12 COMPACTION under traffic is accelerated by use of roller. Blading and smoothing continue during early stage of compaction.

use would be necessary. Complete laboratory tests covering gradation and physical tests of the soils were made and proper mixes were determined.

The first construction consisted of scarifying the existing gravel road and pulling the ditches followed by general reshaping and dressing up of the grade. In this reshaping all the loose material developed was thoroughly mixed with the loose gravel in the windrow by blading back and forth. The final blading was arranged so that a uniform quantity representing 12 cu.yd. of this mixed material per station was windrowed to one side of the road. The balance of loose material, consisting of variations between 10 and 20 cu.yd. per station, was spread and compacted by traffic.

Final control for stabilizing the surface layer was effected by sampling the newly formed windrow at every apparent change point, whether the change point was in gradation or in clay or in silt content. It developed that this procedure required an average of more than ten samples to each mile.

Suggested Variation — Another method of handling existing gravel roads suggests itself. It can be assumed that a serviceable gravel road has adjusted itself to variable support and subgrade conditions. An additional stabilized mat of two to three inches might be constructed on this surface without scarifying or disturbing the supporting power already developed. The additional thickness would secure stability, in even more severe conditions of service, by load distribution through this thickness. In this method the design would be simplified and the work greatly reduced. Sufficient gravel to supply the desired thickness of surface could be placed in windrow. This material could easily be made uniform throughout. The clay deposit could be tested and a uniform mix designed for the entire project. The heavy equipment for scarifying would be eliminated, laboratory and field testing would be greatly reduced and considerable time would be saved. It is entirely possible that the various economies effected by utilization of this method would more than offset the extra cost of some additional material and a better road be assured as well. In this it should be borne in mind that the additional thickness, to be successful, should, at least, be greater than the maximum size of the surfacing gravel particles. Thinner applications of clay-bound gravel would be expected to result in peeling or "pan caking" of the added layer.

Conclusion — The results obtained from the jobs referred to above, as well as from other work lately reported in other states, are really impressive. Our estimate of a successful gravel road is necessarily being revised. It is possible and practical to think of a treated gravel road as a hard compacted surface without associating with it the nuisance of dust, damage of flying gravel and the danger of skidding in the loose gravel present.

The decrease in surface blading, the reduction in material replacements and the added riding comfort due to dust elimination, elevates these roads to a much higher plane in the low-cost road field. Furthermore, as traffic demands or funds permit the construction of a higher type such as oil mat or retread, the traffic-bound surface will afford a very suitable base and the original investment can be utilized one hundred per cent, without the necessity of disturbing the stabilized layer and thereby losing the stability built in by the compaction of time and traffic.

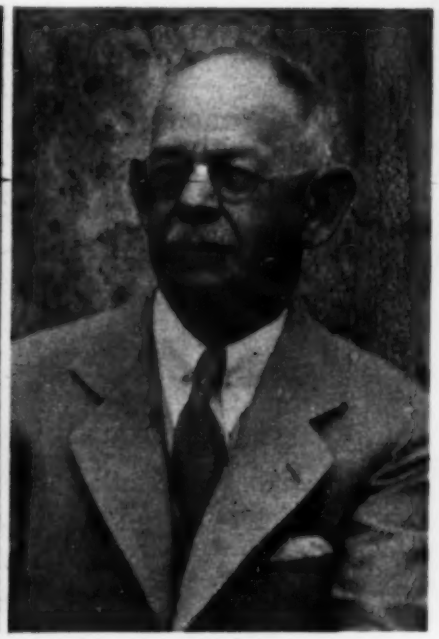
In conclusion we repeat that, by taking advantage of stabilized sand and gravel roads and giving proper consideration to their design, construction and preservation, compact bases, impervious to moisture and of thickness sufficient to distribute the loads imposed without displacement can be provided for oil mat, retread and similar types of surfaces.

13 WHEN MAT IS PROPERLY SHAPED, spreader applies calcium chloride at rate of ¼ lb. or more per square yard to control dust.

14 IN DRY WEATHER several months later fast-moving car raises no dust as it travels over dense, stabilized surface.

Present and Accounted For —

A Page of Personalities



PLANNING AND ADJUSTMENT BOARD MEMBERS— Arthur A. Johnson, *(left)*, president of the Arthur A. Johnson Corp., Long Island City, N. Y., and O. W. Swenson, president of Foley Bros., Inc., New York, have been named as contractor representatives on the newly formed employer-employee tribunal of the construction industry under its NRA Code.

Harris-Ewing Photo

HOUSING ADMINISTRATOR — James A. Moffett, vice-president, Standard Oil Co. of California, has been appointed by President Roosevelt to serve as administrative head of the $500,000,000 program of home repair and modernization contemplated under the new National Housing Act.

GARDNER GANTZ *(below)* was appointed early this year to serve as state highway engineer of South Dakota, succeeding J. H. Lake.

LOUIS R. PERINI, president of B. Perini & Sons, Inc., highway contractors of Framingham, Mass., is the newly elected president of the New England Road Builders' Association. In completing sections of the Boston-Worcester concrete turnpike recently Mr. Perini pioneered in the use of a fleet of 5-yd. truck-mixers and mechanical spreaders, instead of standard pavers, for handling the concrete.

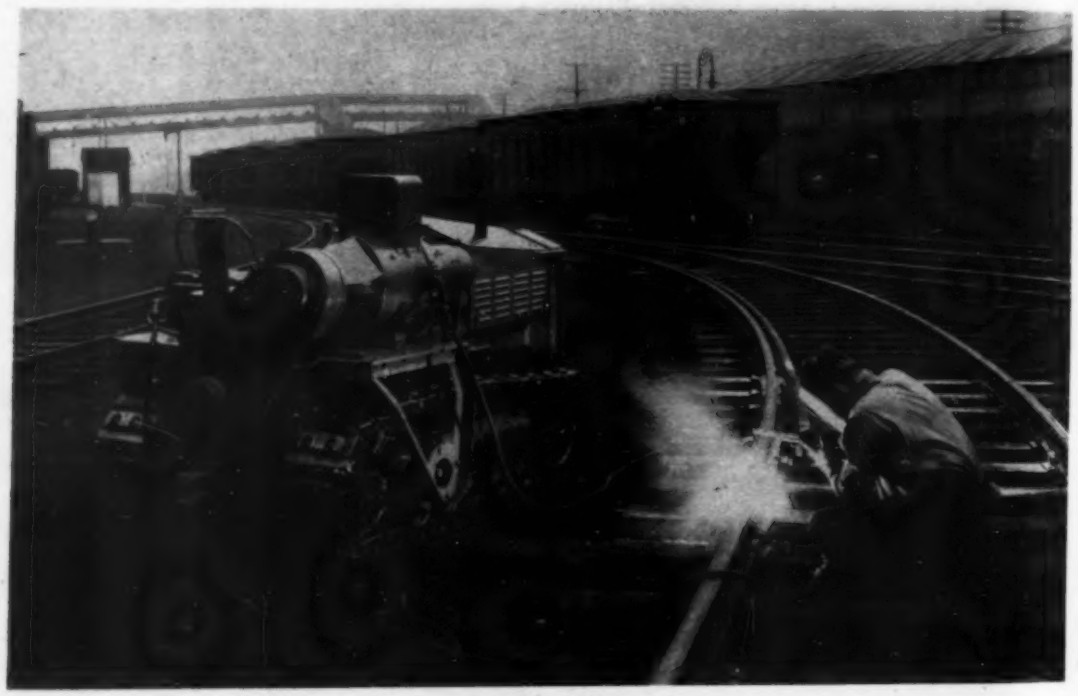
O. F. GOETZ *(below)* formerly assistant engineer in charge of traffic, has been promoted to be chief engineer of the Tennessee Highway Department, succeeding T. C. Ewen.

NEW EQUIPMENT ON THE JOB

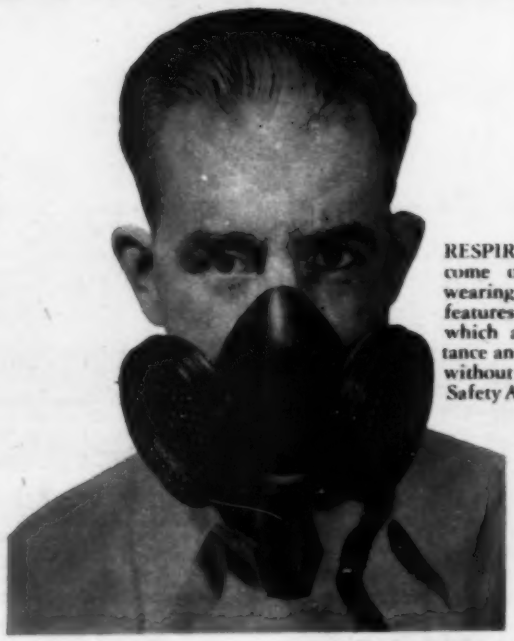
CONCRETE TRANSFER CAR *(left)*, one of three purchased by Tennessee Valley Authority for use on Norris Dam. Capacity 8 cu.yd., each skip holding 4 yd. water level. Traveling on trestle at elevation of crest of dam from mixing plant to cableway buckets, skips are dumped, discharging concrete into hopper which acts as funnel to charge cableway buckets for final placing of concrete. Each car is hauled by Plymouth locomotive with gasoline-electric drive, which also furnishes power for operating skip-hoisting mechanism. Electric equipment and controls furnished by Westinghouse Electric & Mfg. Co. Cars finished with aluminum paint.—Insley Mfg. Co., Indianapolis, Ind.

WELDING HELMET, designed to protect eyes and faces of workers from injury, is made of tough fibre to withstand blows of flying particles and is light enough in weight not to tire wearer. Large lights of laminated safety glass provide wide-angle horizontal and vertical vision. Easily and quickly adjustable. Especially recommended for men who pour babbitt or other molten metal, for workers in plants or laboratories and for operators of machine tools.—American Optical Co., Southbridge, Mass.

TRACTOR-MOUNTED, one-man welder *(below)* designed for ready accessibility to remote maintenance and construction jobs. Easy to maneuver and turn around and may be inclined at an angle of 35 deg. in riding embankments. Welding current and voltage for any job obtained by tuning in as on radio—full range, simultaneous adjustment of both current and open circuit voltage obtained on single-dial control. Flex-arc system of current regulation prevents electrodes sticking and excessive splattering. Three models, 200, 300 and 400 amp., developing speeds of 1,800 r.p.m. Mounted on Cletrac tractors. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

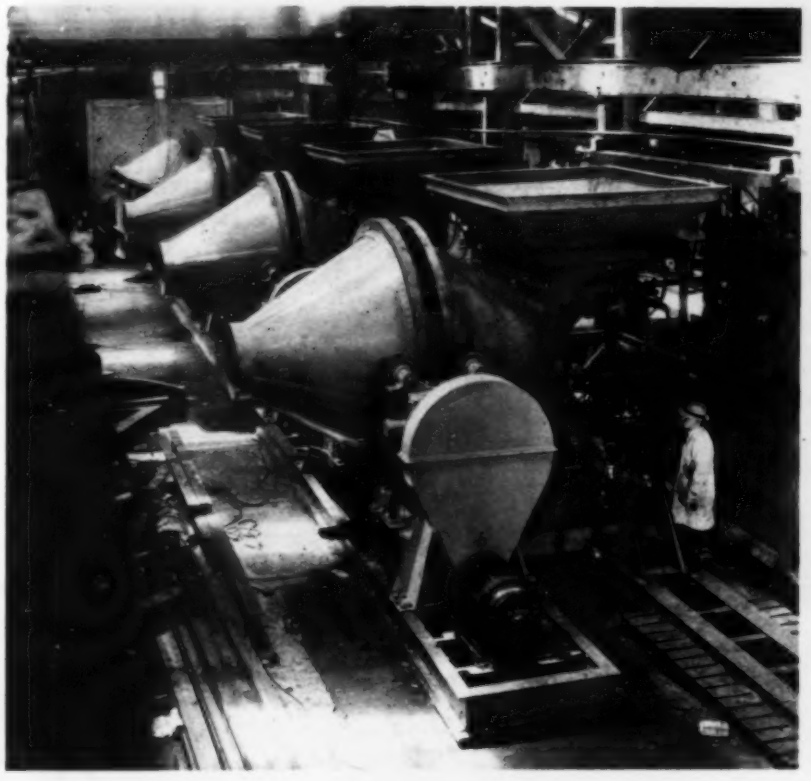


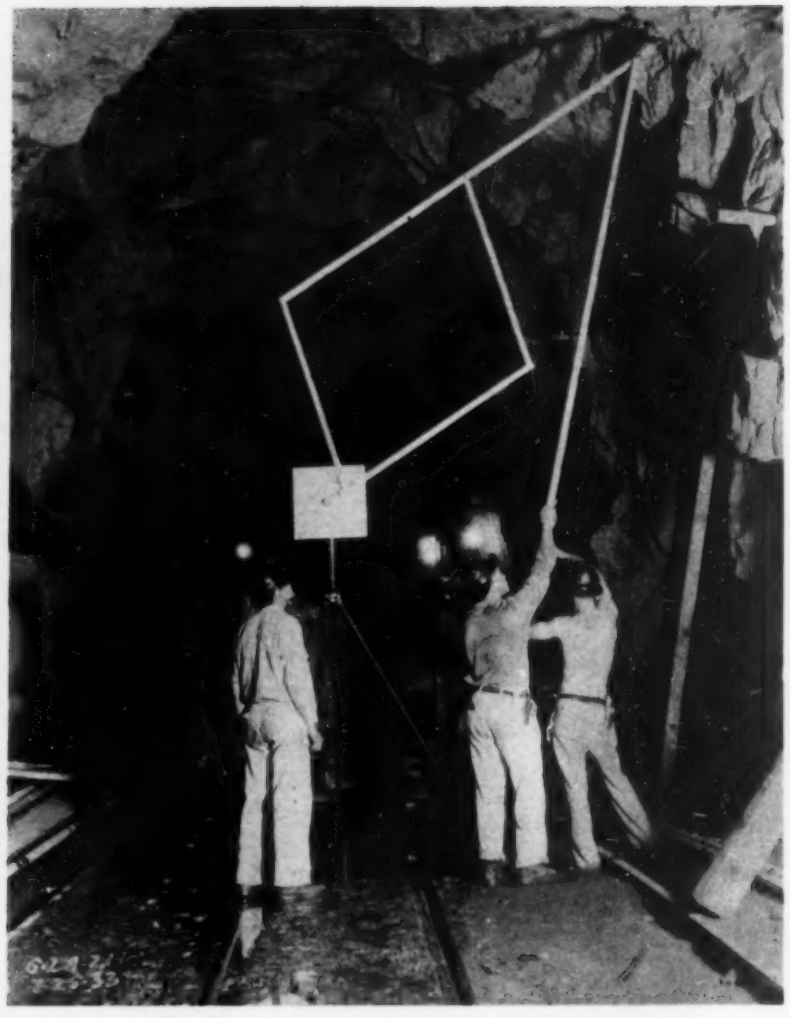
FAST STEAMING and exceptional mobility are advantages claimed for this oil burning boiler mounted on high speed truck to form portable steam heating plant for heating tank cars of bituminous materials, thawing culverts and manhole covers in winter and for steam cleaning machinery. Oil burning units have large storage tanks for water and fuel oil. From cold water start they develop full working steam pressure in 30 min. Fleet of these plants is being used by contractor building bituminous roads in Pennsylvania, New York and Maryland—Cleaver Brooks Co., Milwaukee, Wis.



RESPIRATOR, designed to overcome objections of workmen to wearing dust-respiratory equipment, features use of special filter material which assures low breathing resistance and protection against fine dust without sacrificing lightness—Mine Safety Appliances Co., Pittsburgh, Pa.

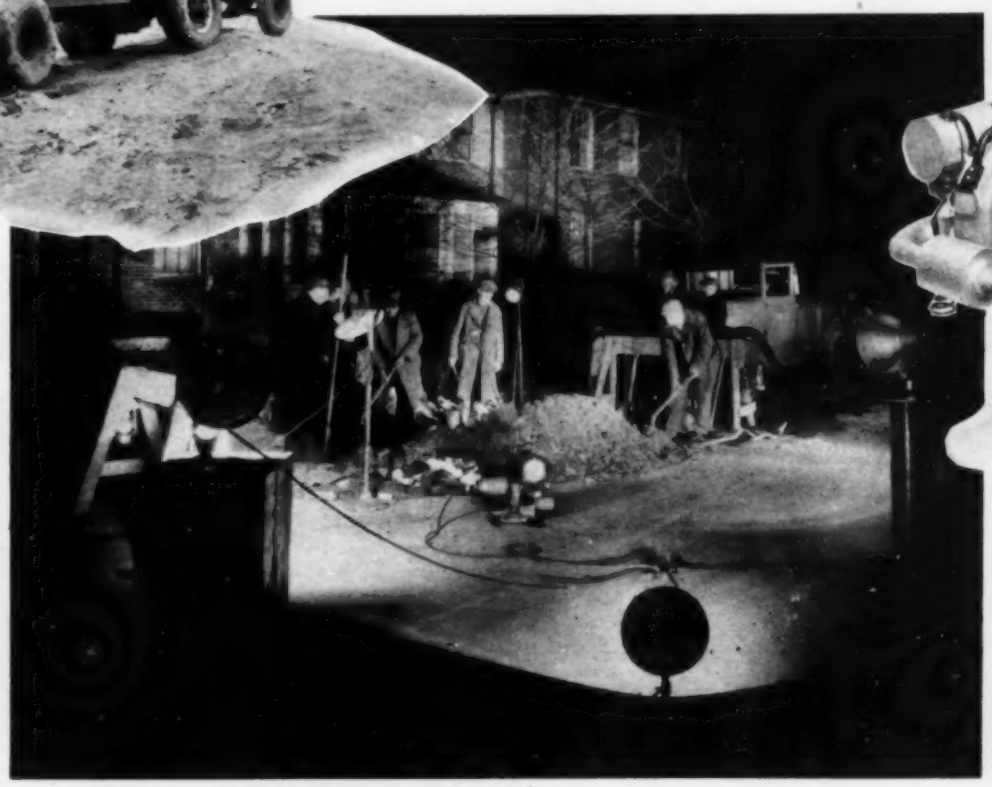
FOUR 2-CU.YD. MIXERS ordered by TVA for use on barges in construction of Joe Wheeler dam. When air-operated discharge gate on hopper is opened, automatic timing arrangement is thereby put in operation, timing period batch remains in mixer. Device locks discharge tilting mechanism so that concrete cannot be discharged until specified mixing time has elapsed. Mixer drums are coated with hard surface material developed by manufacturers of mixers and applied with electric arc-welding machine. Time for mixing batch of concrete is as follows: Charging mixer, 10 sec.; mixing, 2 min.; discharging, 9 sec.; total, 2 min. 19 sec. per complete cycle. Powered by General Electric Motors.—Norris K. Davis, Inc., 400 Seventh St., San Francisco, Calif.





BOTTOM DUMP TRACTOR-TRUCK *(below)* combines speed of motor truck with carrying capacity of crawler wagon. Will carry 6 yd. of earth at speeds ranging to 15 mi. an hour. Powered by 100-hp. engine which provides ample power to operate on steep grades or in soft ground. Short turning radius—approximately 13 ft. Pneumatic tires carry half gross load. Tire tracks furnished for extremely soft or slippery ground—Euclid Road Machinery Co., Cleveland, Ohio.

REPRODUCING accurate cross-sections of tunnels, canals and other earth excavations on a smaller scale for permanent record is accomplished by use of Proebstograph which consists of pantograph wood arm with adjustable pencil, aluminum chart plate and tripod of seamless steel tubing. From these charts may be compiled volume of rock or earth excavated and amount of concrete needed. By use of templets, neat and penalty lines may be outlined making overbreaks and underbreaks discernable. Charts also aid in determining contractor penalties and bonuses. Made in number of sizes suitable for wide range of tunnels.—Farnham & Cunningham, M29 Edison Bldg., Los Angeles, Calif.



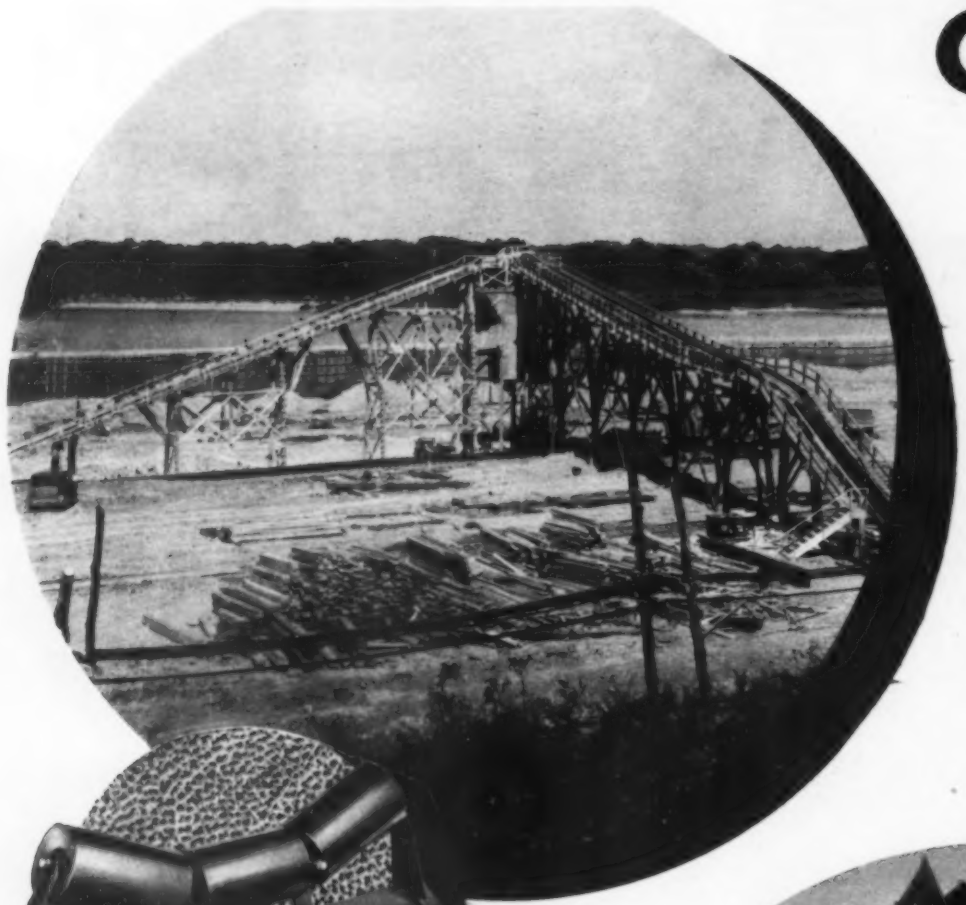
PORTABLE GENERATOR *(right)* for operating floodlights for night construction and repair work makes 100-v. current readily available whenever needed. Consists of generator driven by gasoline engine. Unit has capacity of 1,250 w., weighs 89 lb. and may be carried by one man *(insert)*. High-tension magneto generates hot spark insuring easy starting. Weatherproof and dust-proof. Generators also used for operating electric drills, saws, sanders, hammers and other electric tools and equipment.—Homelite Corp., 87 Riverdale Ave., Port Chester, N. Y.

If You Want Further Information

Within the space limits of this page it is impossible to present complete information about the products illustrated.

The manufacturers, however, will be glad to supply further details if you will write to them.

Conveying



Here are two of the six Barber-Greene Conveyors on this job that are performing day and night in typical B-G trouble free fashion. Sand is brought in in barges, carried by one Barber-Greene to the storage pile. Two B-G's, one a tunnel conveyor under the storage, and one inclined conveyor, elevate the material to the mixing plant. Stone is shipped in cars, dumped onto two B-G tunnel conveyors, and then conveyed to the mixing plant.

Material handling is not only a big part — but a key function in most construction jobs.

Use Barber-Greenes and know that you're handling your material as cheaply, as rapidly, as dependably as possible.

At the left is the B-G Roller Bearing Carrier. A card or letter will bring our new Bulletin, showing all B-G Carriers.

Loading

The varied, tough jobs which loaders are called upon to do require stamina, ruggedness — modern design. This is the largest of the standard B-G Bucket Loaders, the Super 62. Its outstanding performance is not due to ruggedness and weight alone. For example, it has the patented B-G Floating Boom, which makes all crowding thrust go direct from the crawlers to the foot end — not through the main frame. The 62 could crowd a stone wall without danger of damaging the crawler drive, as the B-G Patented Automatic Overload Release slips as soon as an overload occurs, and then automatically re-engages. The same type of over-load release protects the bucket line from strain.

These are just a few of the high spots. Write for literature. There is no obligation.

Representatives in Principal Cities.

"Loader" is a rather mild name for a machine that digs through hard packed materials like the B-G spiral feed on the 62 is doing here. Ask for Bulletin No. 62 for details.

Standardized Material Handling Machines

BARBER GREENE

530 West Park Avenue,
Aurora, Illinois

Cable Address—BARGREENE

not all Crawler tractors are CLETRACS

. . . those are which are "Built to Endure"

. . . From coast to coast, from the uncharted wilderness of the frozen north to the lower levees of the Mississippi, Cletracs prove their right to the slogan—"Built to Endure." • Shown below, a Cletrac 80 Diesel working at an altitude of 8000 feet is completing a rocky fill in record time and with record economy. In the opinion of the owners of this tractor, "it has to be good" to stand up day after day over this rocky going without a delay. • Why not get the money-making advantages of Cletrac's proved economy and reliability for your own work? • Models with horsepower rating of 20, 25, 35, 55 and the great Cletrac 80, world's most powerful automotive unit.

THE CLEVELAND TRACTOR COMPANY, CLEVELAND, OHIO, U. S. A.

Cletrac
Crawler Tractors
Built To Endure

"ROADS of the WORLD"

. . . with TARVIA representing a Modern Highway

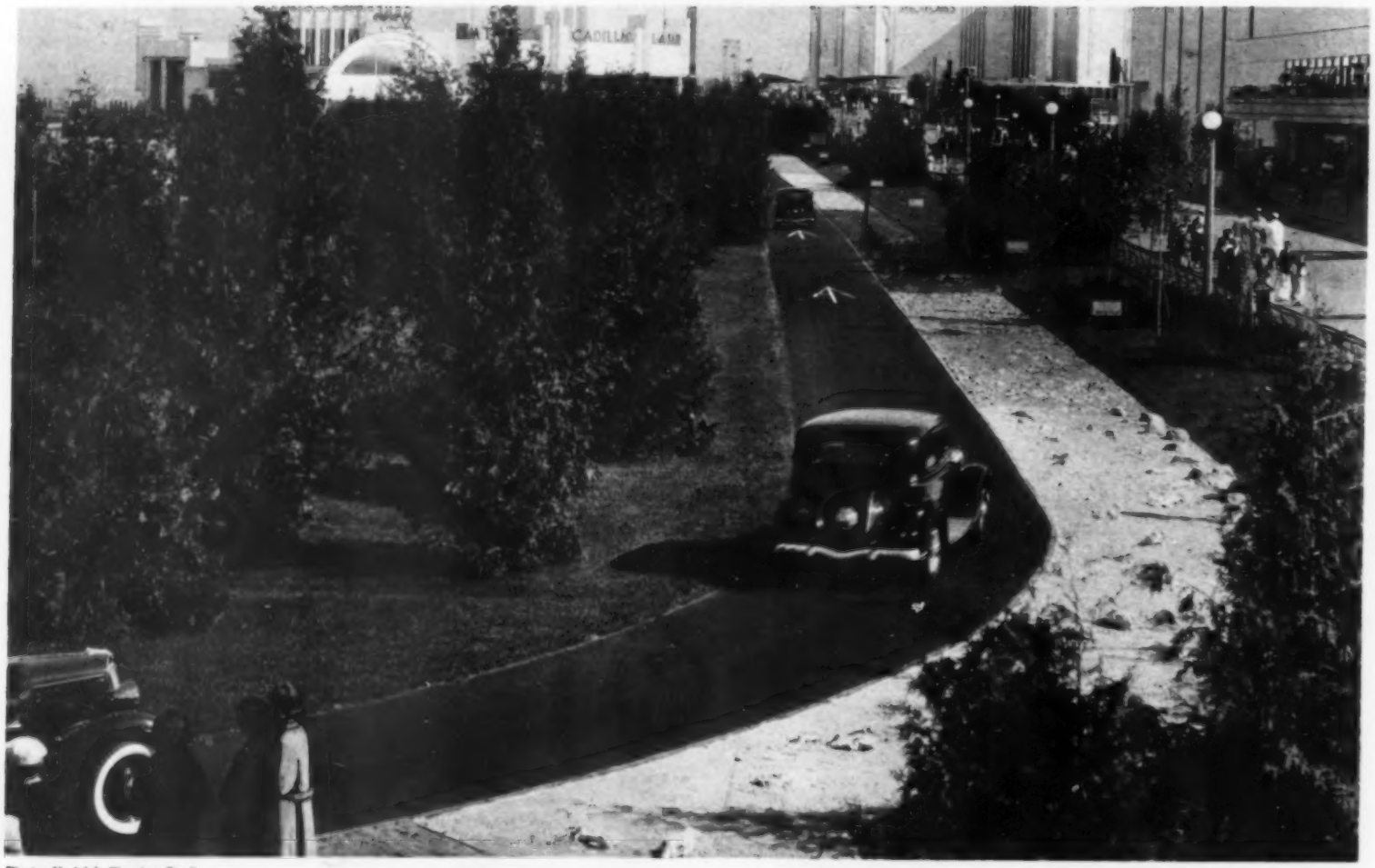


Photo: Hedrich Blessing Studio

"Roads of the World," a feature of Ford Expos tion at the Chicago Fair. Visitors are given complimentary courtesy rides in Ford V-8's on a Tarvia road that encircles replicas of historic highways. *Contractor:* Rock-Road Construction Company, Chicago, Ill.

VISITORS at the magnificent Ford Exhibit at "A Century of Progress" in Chicago may see not only the development of the Ford automobile and how it is made . . .

They may see also the development of that other essential of every good automobile ride—the *highway*. Reproductions of twenty-one different types of roads—from prehistoric desert trails to modern highways—have been built as part of Ford Exposition. And THE road built for visitors to ride on while they view the "Roads of the World" is a Tarvia road.

Tarvia is—and always has been—the road for the sensible citizen in the sensible community. It is smooth, easy-riding, trouble-free, lasts a long, long time—and costs little to construct or maintain.

Tarvia is truly a "Road of the World." There may be communities here and there able to justify and pay for "show roads," but the road most of the world can appreciate from all angles—especially that of cost—is a Tarvia road.

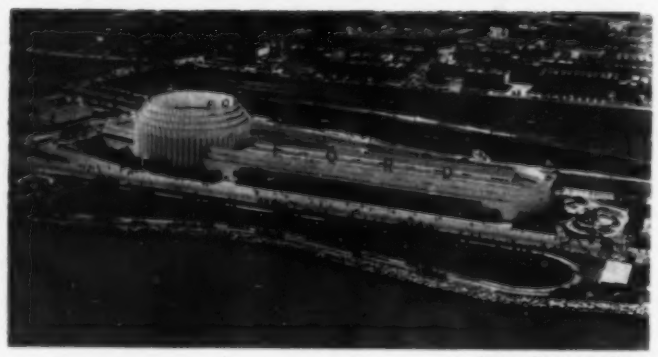


Photo: Kaufmann-Fabry

Air view of Ford Exposition showing "Roads of the World" in the foreground. The main exhibit building is roofed with another famous product of The Barrett Company, Barrett Roofing.

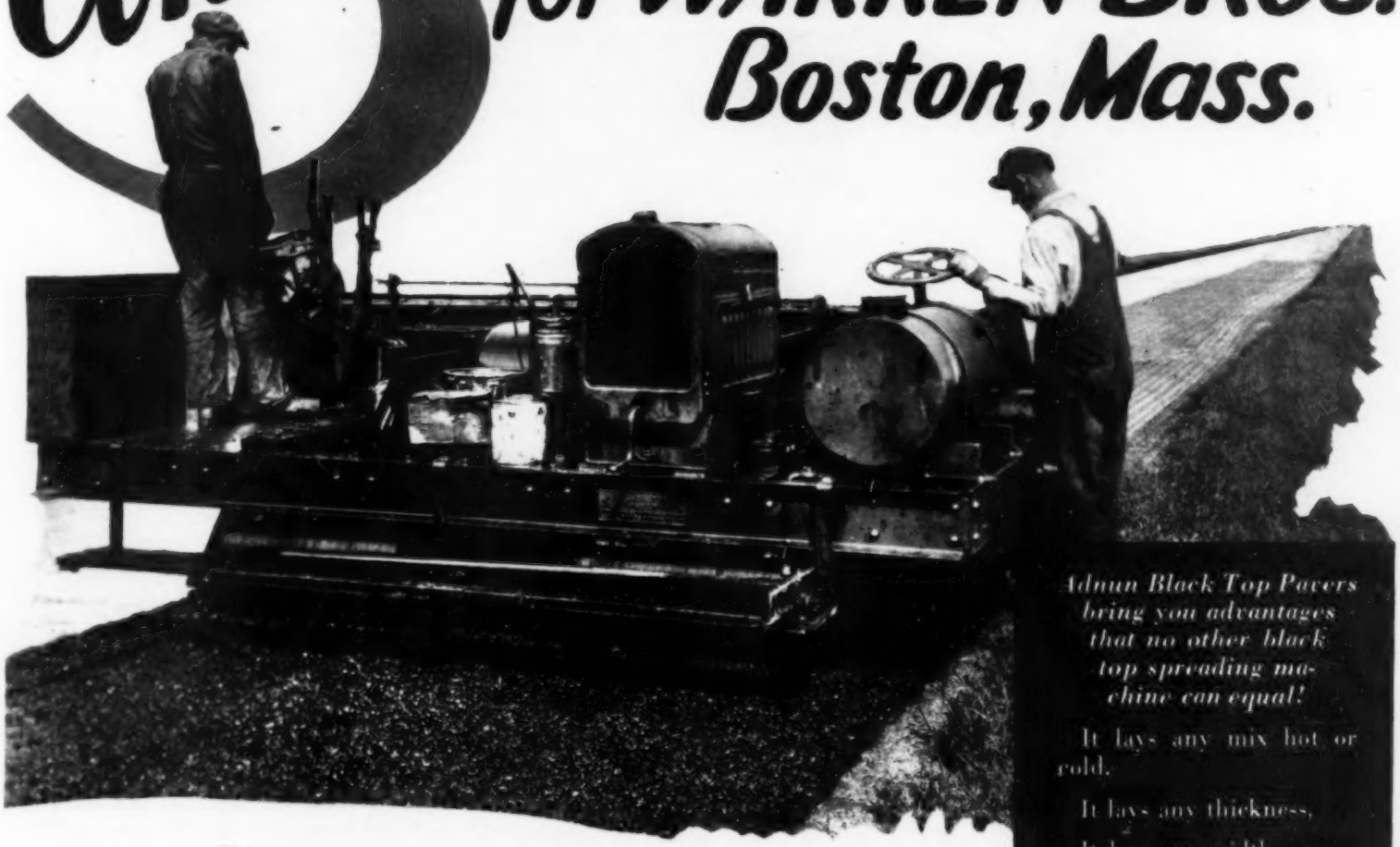
Tarvia
GOOD ROADS
at LOW COST

THE BARRETT COMPANY New York · Chicago · Philadelphia
Cleveland · Boston · St. Louis · Minneapolis · Lebanon · Toledo
Birmingham · Detroit · Baltimore · Columbus · Youngstown
Milwaukee · Buffalo · Providence · Syracuse · Hartford · Cincinnati
Bethlehem · Rochester · Portland, Me. · · THE BARRETT
COMPANY, LTD., Montreal · Toronto · Winnipeg · Vancouver

ADNUN

BLACK TOP PAVER

Another for WARREN BROS. Boston, Mass.



ANOTHER endorsement that every bidder on black top work should consider.

Warren Brothers, well known highway contractors of Boston, Mass. have just purchased their third Adnun Black Top Paver.

More than anything else, a repeat order is evidence of satisfactory service—it is the finest testimonial that any manufacturer can exhibit.

The experience of such concerns as Warren Brothers is well worth your consideration.

ADNUN ENGINEERING & MFG. CO.
Nunda, New York

Adnun Black Top Pavers bring you advantages that no other black top spreading machine can equal!

It lays any mix hot or cold.

It lays any thickness.

It lays any width.

It needs no forms or shoulder preparation.

A simple adjustment permits crowning the road on banking curves.

And with the Adnun cutter bar, an exclusive advantage, it assures an accuracy and smoothness impossible by hand labor.

If you are bidding on black top you need the Adnun Black Top Paver. It means a better job with more profit.

Why not find out why leading contractors are buying them. Write for complete information.

ADNUN

BLACK TOP PAVER

Two valuable books for highway engineers

CONCRETE ROAD DESIGN
SIMPLIFIED AND CORRELATED WITH TRAFFIC
SHORT COUNT TRAFFIC SURVEYS
AND THEIR APPLICATION TO HIGHWAY DESIGN
HIGHWAY PLANNING AND DESIGN SERIES No. 3

FRANK T. SHEETS, for 9 years Chief Highway Engineer of the State of Illinois, now Consulting Engineer of the Portland Cement Association, is the author of *"Concrete Road Design."* Ten thousand miles of concrete roads were built on the Illinois State Highway System under his direction.

DR. MILLER McCLINTOCK, nationally known traffic expert, director of the Albert Russel Erskine Traffic Bureau of Harvard University, has prepared a companion book, *"Short Count Traffic Surveys."* He has been employed by Los Angeles, San Francisco, Chicago, Boston and other cities as the acknowledged authority in his line.

IN CLEAR, short-cut language these books tell you: *first,* how to predict quite accurately the traffic load which any new section of street or highway will have to carry; *second,* how to design a concrete slab to meet that traffic load adequately . . . . at minimum expense.

Unique Advantage of Concrete for Roads

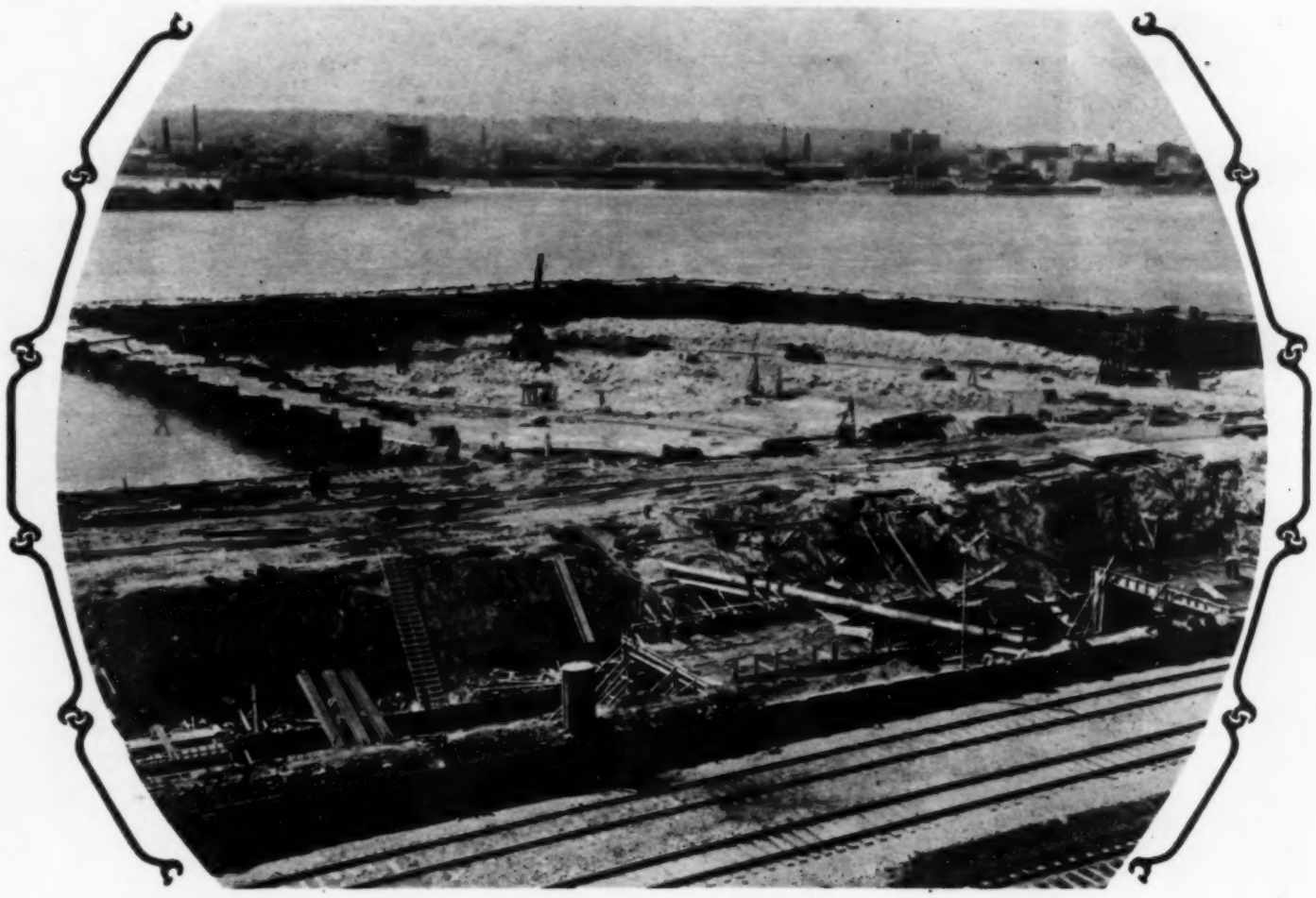
As Sheets demonstrates, it is possible to design a concrete slab to meet precisely and economically the requirements of any type of traffic. But only for concrete are the necessary basic facts available on stresses, fatigue, etc.

If roads are to be accurately designed to fit the loads they are to carry—concrete must be used. These books show best how to do it.

Both books are free to any engineer for the asking. Write to Room 328.

PORTLAND CEMENT ASSOCIATION

Room 328, 33 West Grand Avenue, Chicago, Illinois



YOUR JOB IS <u>SAFE</u> BEHIND COFFERDAMS OF ··

ILLINOIS STEEL SHEET PILING

Properly designed, the cellular cofferdam of Steel Sheet Piling is the surest protection against strong currents, high seas, earth or water pressure, or unforseen emergencies.

Steel Sheet Piling presents real opportunity for economy, since it can be used again and again.

Our engineers will be glad to consult with you regarding design or construction.

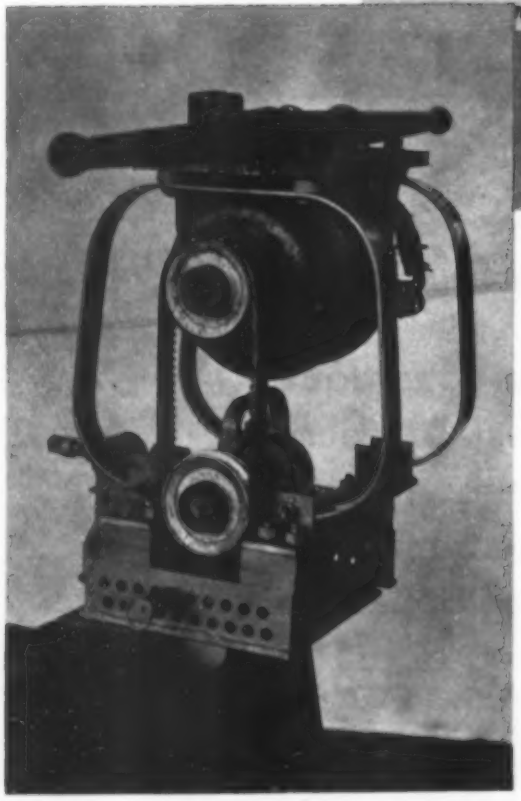
Illinois Steel Company

208 SOUTH LA SALLE STREET, CHICAGO, ILLINOIS

SUBSIDIARY OF UNITED STATES STEEL CORPORATION

This is the story of a new-type vibration process to improve construction

VIBRATE THE STEEL FOR BETTER CONCRETE
STRENGTH WHERE YOU NEED IT...
DENSE, STRONG CONCRETE PLACED WHERE IT SHOULD BE
300% MORE BOND STRENGTH—HIGH DENSITY—
VOIDS ELIMINATED—COMPRESSIVE STRENGTH
PRACTICALLY DOUBLED



Beam pulsator of the International Vibration Company, Cleveland, Ohio, equipped with General Electric 3-hp. motor

. . . . and HERE'S the STORY of G-E EQUIPMENT ON THE VIBRATOR

IT is natural to find G-E motors and control on this new portable vibrator, used in the modern steel-vibration method for producing dense, strong concrete. Both the builder and the users of the vibrator know G-E equipment is dependable and will give extra years of trouble-free operation.

These vibrators, clamped to steel building frames, are being used to produce concrete of high density and great compressive strength in floor arches, fireproofing, and other types of construction. Tests of this process have shown that it produces concrete bonded to the steel with as much as 300-per-cent-greater strength than by former methods.

The use of G-E equipment on this new vibrator is another indication of the preference of builders and users for G-E motors and control on construction machinery. Many construction engineers with wide experience demand G-E equipment for all kinds of jobs, from the smallest to the biggest and toughest.

Whatever your construction project, you, too, will find that G-E motors control and speed your work and lower your costs. Before starting your next job, call in a G-E engineer and let him show you how General Electric can help you—save you money. General Electric Company, Schenectady, N. Y.

020-67

GENERAL ELECTRIC

THE "GOING" PRICE

NO buyer will pay anyone a premium for a standard product like gasoline, cane sugar or No. 1 wheat. The lowest price that any seller offers becomes the going price.

Modern portland cement is a uniform product, conforming to standard specifications of the U. S. Government and the American Society for Testing Materials. It is only natural, then, that buyers refuse to pay more for one brand than another.

To illustrate, let us assume you are a cement buyer in Kokomo, Indiana. A dozen cement plants are soliciting your business. Quotations are being received from them regularly. Each plant is selling a uniform, standardized product — a commodity as staple as cane sugar or No. 1 wheat.

Will you pay any of these cement plants a higher delivered price than that quoted by some other? No! You will buy this uniform and interchangeable product from the cement plant that is quoting you the lowest delivered price.

Under such conditions, how can any other plant hope to get your business? Obviously, only by quoting a price as low as the lowest price offered. The lowest price finally reached in the general bargaining process is known as the going price. It is the lowest any cement plant will quote in Kokomo in order to get not only your business but that of other buyers. Until some plant ventures to quote a lower price, it is the price at which all cement in Kokomo will be sold.

So it happens that in every town and city there is a going price for portland cement . . . a uniform rock-bottom price below which no plant cares to go.

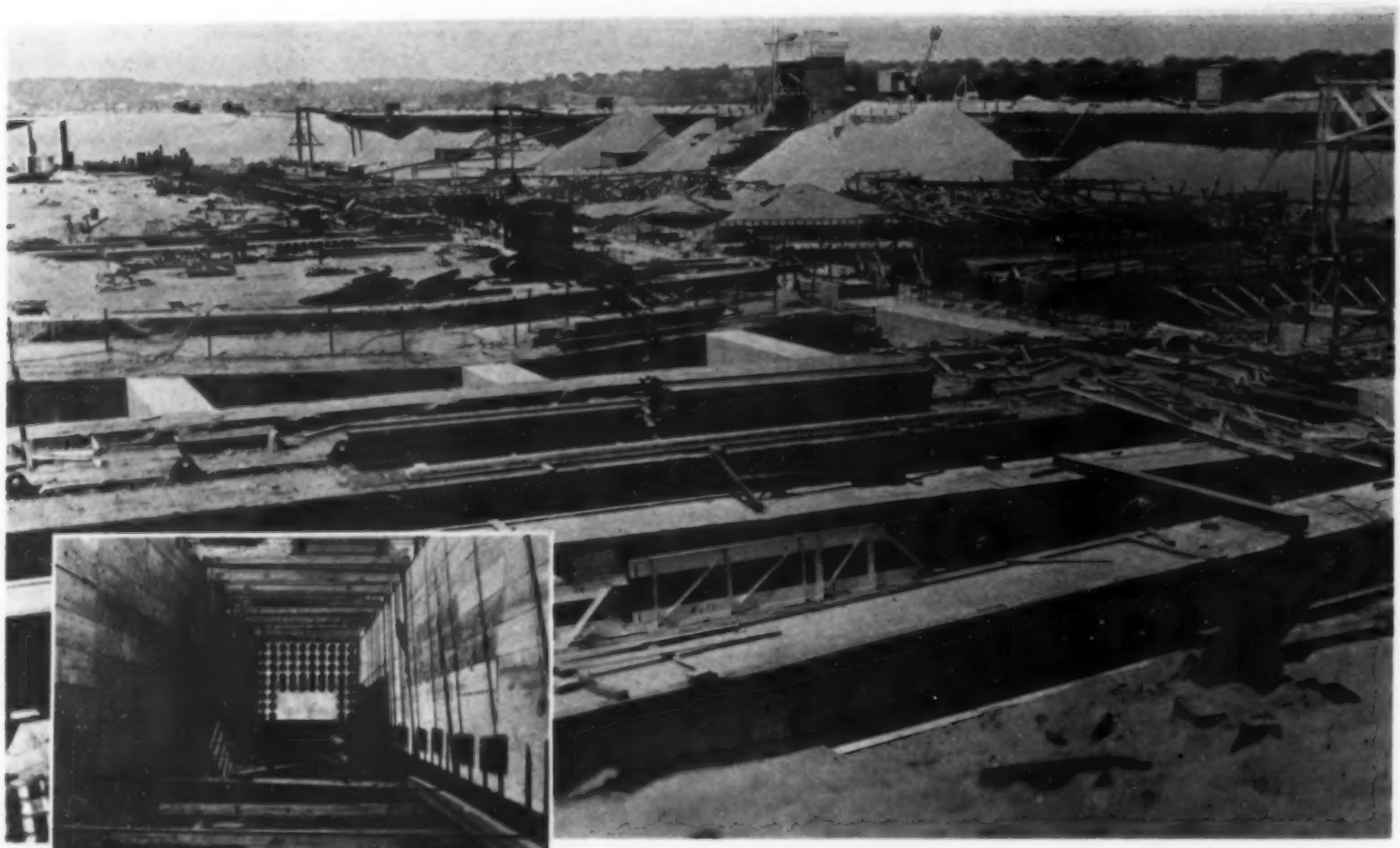
Since all prices tend to equal the lowest price that any seller offers, a buyer always can buy from any mill he likes. At the same time he also buys at the lowest price prevailing in that market. In short, the going price is equal to the lowest price that any seller offers.

THE CEMENT INSTITUTE

NEW YORK · CHICAGO · KANSAS CITY

This is one of a series. Copies of previous advertisements will be sent on request.

GOING FORWARD WITH CEMENT



a few typical

MORETRENCH JOBS

Knickerbocker Village Foundation
Louisville Outfall Sewer
Winfield Lock, Kanawha River
Dam No. 5, Mississippi River
Dam No. 20, Mississippi River
Cape Cod Canal Bridge Piers
Sea Wall, Fort Monroe, Va.
Sewer Construction, Buffalo
Subway Work, New York and Newark
Foundations-Washington Gas Holder

THE Cofferdam on Lock Sixteen encloses an area of about ten acres. Deepest subgrade is some twenty feet below the surface of the Mississippi at low water stage.

IN JANUARY 1934 – open pumping was a heavy handicap.

IN FEBRUARY – a Moretrench Wellpoint System made everybody happy – and with the check rein off, the gang tore into action.

IN MAY – came the floods. The river rose ten feet. *But the deepest footings for the big conduit crossover were dug in the dry.* The Moretrench Wellpoint System functioned perfectly under a head of thirty feet.

The Moretrench way is the sensible low cost way.

Send for Catalog

MORETRENCH CORPORATION

Works:
Rockaway, New Jersey

Sales Office:
90 West Street, New York City

CHEVROLET TRUCKS

haul more . . last longer . . cost less to run

Six-cylinder valve-in-head design—the most economical truck engine built

CHEVROLET Chevrolet trucks have *earned* their popularity —their unchallenged leadership as America's *fastest selling trucks.* Truck owners who keep cost records say that Chevrolet six-cylinder valve-in-head trucks are the most economical trucks you can buy—costing less for gas, for oil and for upkeep. Most owners who have tried different makes of trucks standardize on Chevrolets—convinced that Chevrolets stand up better and last longer. Many Chevrolet trucks have never lost a day in 100,000 to 200,000 miles of hauling. The 1934 line of Chevrolet trucks is bigger and huskier—all truck throughout. Load capacity in some units has been increased 20 to 30 per cent. The six-cylinder valve-in-head Chevrolet engine is more economical than ever. As always, you can haul more and save more with Chevrolets—the *lowest-priced* six-cylinder trucks.

CHEVROLET MOTOR COMPANY, DETROIT, MICHIGAN

Compare Chevrolet's low delivered prices and easy G. M. A. C. terms.

A General Motors Value.

160,468 Miles . . . 1½-ton Chevrolet truck, in service eight years, hauling loads of paper averaging 2½ tons. Averaged 20 miles per gallon of gasoline on trips to Philadelphia under same load. One valve grind, new distributor points, new spark plugs only mechanical expense in 160,468 miles.

Joshua Rollman, Lititz, Penn.

115,000 Miles . . . Owner so pleased with 1932 Chevrolet truck that he bought a 1934 Chevrolet truck. The 1932 truck covered 115,000 miles in wholesale grocery hauling—average load 6 tons over mountain and desert country. Total operating cost, including depreciation, only 4.3 cents per mile. Gasoline mileage averaged 12 miles—no oil needed between changes at 1800-mile intervals.

C. B. Griffith, Ontario, Calif.

125,000 Miles . . . 1932 Chevrolet truck. Two valve grinds and one brake relining only repair expense in 125,000 miles. Averages 10 miles per gallon of gas, covering 8,000 miles per month with semi-trailer.

William Emmons, Los Angeles, Calif.

200,000 Miles . . . 144,218 Miles . . . 1931 Chevrolet 157-inch truck with dual wheels has covered 200,000 miles—still in first-class condition. Another Chevrolet 131-inch stake truck, purchased in 1930, has been driven 144,218 miles—operating costs about 50 per cent less than other makes of trucks in the same class and in the same service. These trucks will be replaced with 1934 Chevrolet trucks. Owner is standardizing on Chevrolets—plans to add two more to fleet soon.

Highway Express, Perry, N. Y.

Time Saved in Moving Means More Time Digging

THE exclusive Walking Traction of the Bucyrus-Monighan Walking Dragline saves time on every move, and enables this machine to use its great digging capacity a maximum percentage of its working hours.

The Walker can turn, at any angle, in any space large enough to accommodate its base. Its pivoted walking treads adjust to rough footing; and its separate circular base and Walking Traction, with large bearing areas, enable it to move and excavate on soft footing.

Investigate the Walker's varied tasks which include: Drainage Work; Hydro-Electric Development; Levees and Embankments; Reservoirs and Dams; Railroad Embankments; Sewer and Pipe Line Trenches; Coal, Gravel and Quarry Stripping and Excavation; Channel Changes, etc.—its adaptability is limitless. Bucyrus-Monighan Company, Chicago, Ill.

BUCYRUS MONIGHAN

Walking Draglines 1 to 10 cubic yards

Sold by

BUCYRUS-ERIE COMPANY

South Milwaukee, Wisconsin

Representatives throughout the U. S. A. Branch Offices: Boston, New York, Philadelphia, Birmingham, Chicago, Pittsburgh, St. Louis, Kansas City, Dallas, San Francisco. Offices or Distributors throughout the world. B-60

Levee Construction

River Channel Changes

Stripping Coal

Building an Embankment by Direct Fill and with Dump Cars

Gravel Pit Stripping and Excavating

1 of EIGHT BAY-CITY'S Shipped to Michigan County Road Commissions in 1934

During the past three months, eight Bay-City Shovels have been purchased by Michigan County Road Commissions. Here is pictured one of the eight—a Half Yard Heavy Duty full-revolving machine that will *return profits* to counties on road work. Bay-City Shovels, available in capacities of ⅜ yds. to 1¼ yds., are convertible—use them as dragline, trench-hoe or skimmer—for all kinds of earth moving jobs.

Bay-City users are Bay-City boosters—they know that on large jobs as well as small ones a Bay-City will put in a full day's work. Are you aware of the economy of Bay-City machines on your work? Frictionless bearings, Unit castings, Helical cut gears, Drop-forged steel crawler shoes, chain crowd, manganese buckets, Electric digger trip—are only part of the story.

BAY-CITY SHOVELS Inc.

BAY CITY, MICH. U. S. A.

NOW—a Complete System of *Automatic* Batching

Completely illustrated and described in Catalogue No. 1487 — Blaw-Knox Automatic Batching Equipment.

Send for your copy.

BLAW-KNOX COMPANY

2086 FARMERS BANK BUILDING, PITT., PA. Offices and Representatives in Principal Cities

BLAW-KNOX

Cofferdam for Pier 2

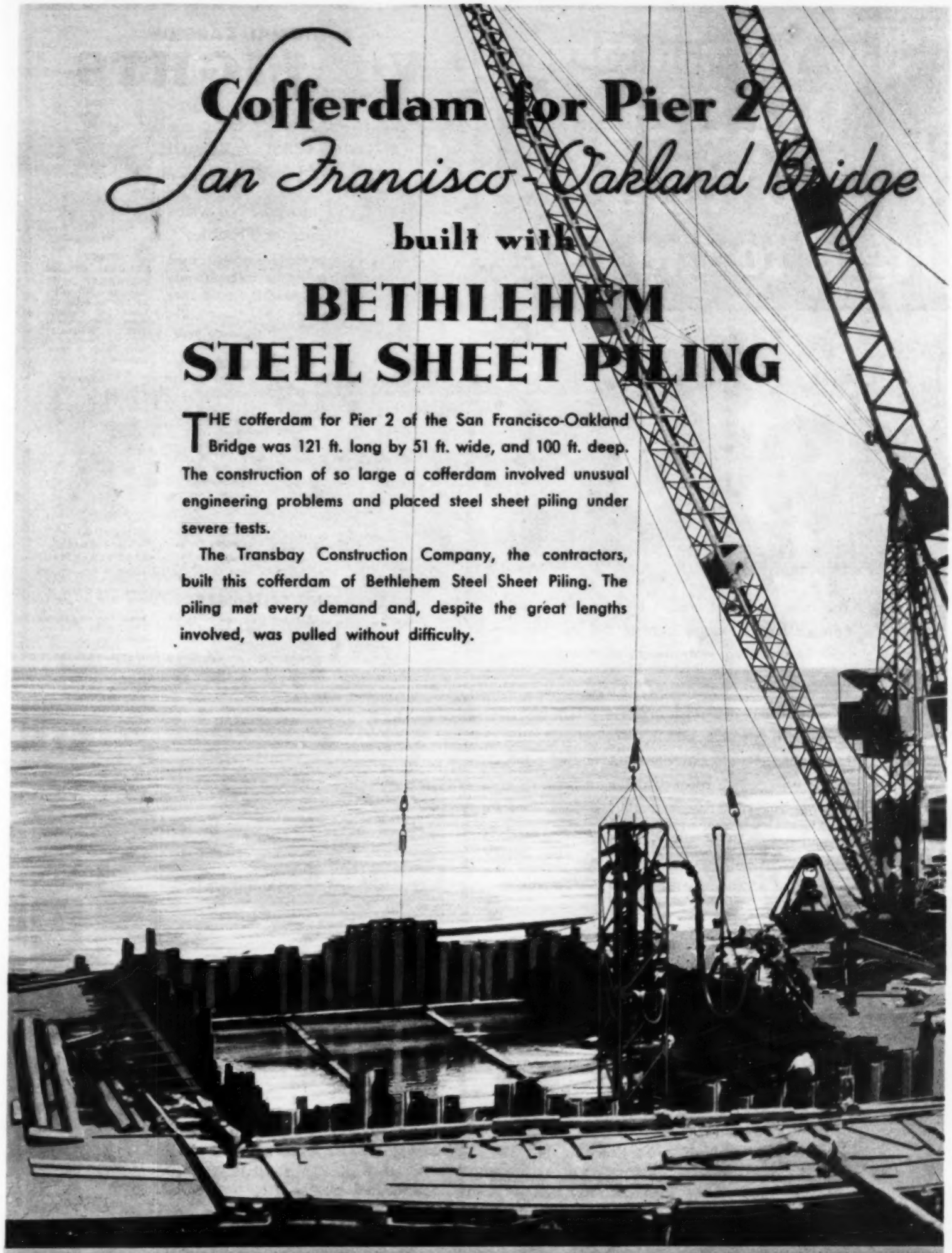
San Francisco-Oakland Bridge

built with

BETHLEHEM STEEL SHEET PILING

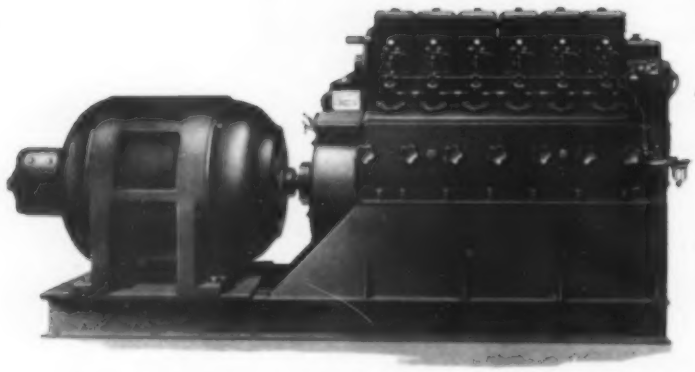
THE cofferdam for Pier 2 of the San Francisco-Oakland Bridge was 121 ft. long by 51 ft. wide, and 100 ft. deep. The construction of so large a cofferdam involved unusual engineering problems and placed steel sheet piling under severe tests.

The Transbay Construction Company, the contractors, built this cofferdam of Bethlehem Steel Sheet Piling. The piling met every demand and, despite the great lengths involved, was pulled without difficulty.



KALMAN STEEL CORPORATION, Subsidiary of Bethlehem Steel Corporation. General Offices: Bethlehem, Pa.
District Offices: Albany, Atlanta, Baltimore, Boston, Buffalo, Chicago, Cleveland, Cincinnati, Detroit, Houston, Milwaukee, Minneapolis, New York, Philadelphia, Pittsburgh, St. Louis, St. Paul, Syracuse, Washington. Pacific Coast Distributor: Pacific Coast Steel Corporation, San Francisco, Los Angeles, Seattle, Portland, Honolulu. Export Distributor: Bethlehem Steel Export Corporation, New York.

Now you can take DIESEL POWER *right to the job!*



● The new F-M light weight high speed Diesel brings Diesel economy right to the job that is "on the move" or only temporarily stationary.

This engine is light enough for truck mounting or other forms of easy transportation. It is big enough, 10 to 60 h.p., one to six cylinders, to furnish light for night operations, it's big enough to furnish "air" to a lot of pneumatic tools. It will operate a good sized hoist. It will drive grinders, hammers or any other tools you must use on the job. It's the cheapest form of power you can use on a mixer or paver. It will drive a pretty big pump.

This engine enables you to take plenty of economical power right to the job or along with the job as it progresses. It means the cheapest form of power known to engineering has become available to the construction industry.

These engines are furnished, as you desire, with or without generator, pump or compressor.

For full information write Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago, Ill. 32 branches at your service throughout the United States.

Pioneer Designers and Manufacturers of POWER, PUMPING AND WEIGHING EQUIPMENT 104 Years

FAIRBANKS-MORSE
DIESEL ENGINES

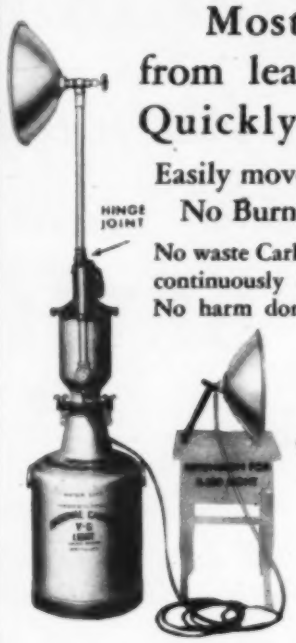
6058-0A31.14

NATIONAL CARBIDE

V-G LIGHTS

Most Light
from least Carbide
Quickly Charged

Easily moved—No wires
No Burner Troubles



No waste Carbide whether used continuously or intermittently
No harm done if tipped over

—

Extension to X-100 DOUBLES THE CANDLE POWER *fastens anywhere*

—

Always use NATIONAL CARBIDE *"In the Red Drum"* Distributors Coast to Coast

—

WRITE FOR COMPLETE INFORMATION

—

Y199
NATIONAL CARBIDE V-G HANDY LIGHT
Burns about 5½ hours on 1¼ lbs. of 14-ND Carbide, 2 gals. water; delivers about 1500 c.p. Weighs 37 lbs. charged—easy to carry, handy in emergencies.

WL1-C1
NATIONAL CARBIDE LANTERN
Burns 8 hrs. on 8 oz. of Carbide. Brilliant rear signal of red, blue or green, no extra charge . . . Ideal for emergency lighting on road at night.

X-100
NATIONAL CARBIDE V-G LIGHT
About 8,000 c.p. for 12 hours on 7 lb. charge of National Carbide. Easily handled by one man. Weight 35 lbs. empty; 98 lbs. full.

NATIONAL CARBIDE SALES CORP.
LINCOLN BUILDING
Opposite Grand Central, NEW YORK

BAKER

Constructing Golf Course In Forest Park (Queens), N. Y.

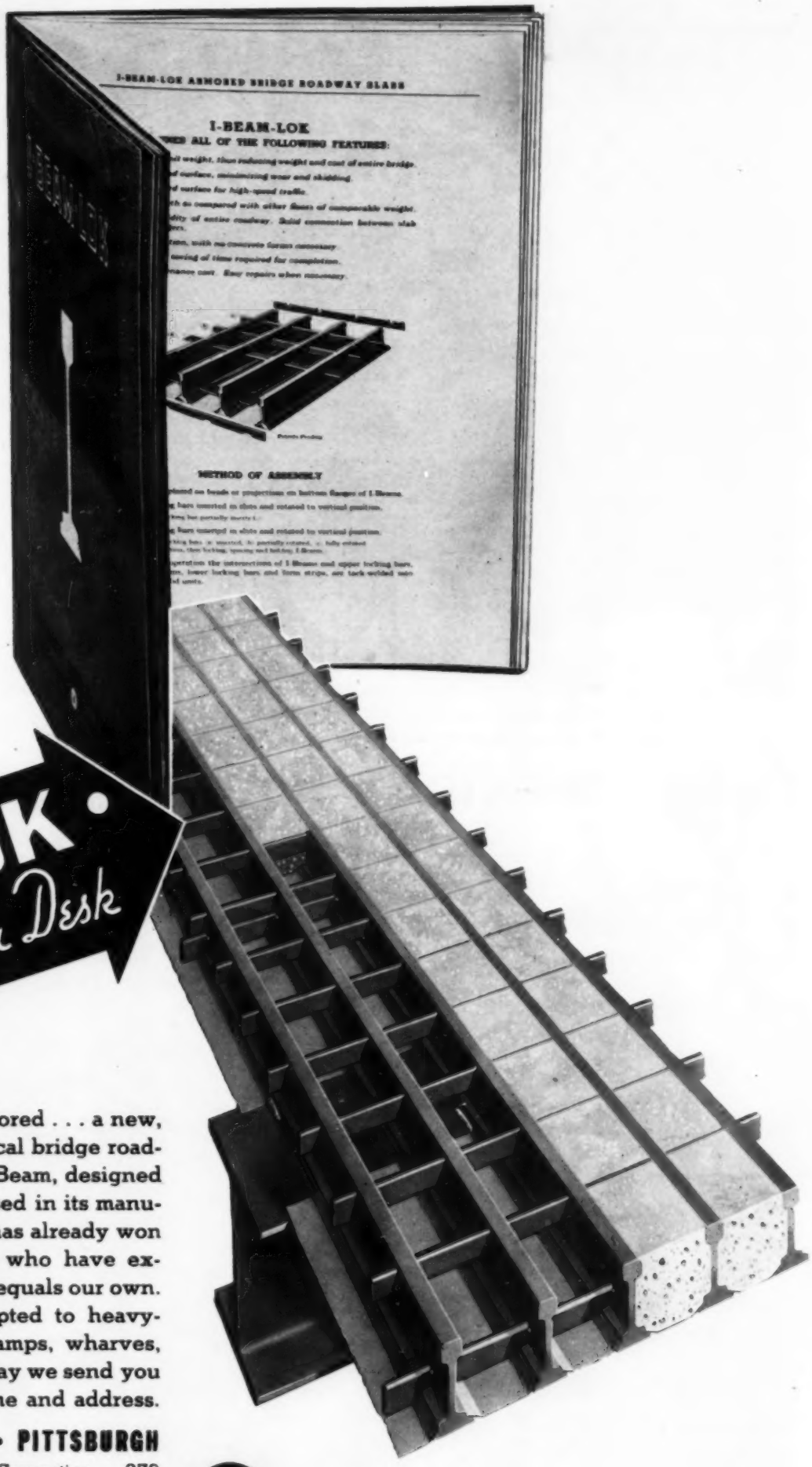
There are many reasons why so many nationally prominent construction companies use Baker Double Pressure Hydraulic Bulldozers. Simple construction — few wearing parts — easy, quick blade control — everything accessible — compact sturdy construction — common-sense mounting on tractors.

Send for new 24-page booklet on Bulldozers

THE BAKER MANUFACTURING CO.
568 Stanford Ave. Springfield, Ill.

Two Baker Bulldozers levelling at Jacob Riis Park, Brooklyn

BULLDOZERS



This BOOK Should be on your Desk

• It describes I-Beam-Lok Armored . . . a new, lighter, stronger. more economical bridge roadway construction. A special I-Beam, designed for this particular puspose, is used in its manufacture. I-Beam-Lok Armored has already won the endorsement of engineers who have examined it and their enthusiasm equals our own.

I-Beam-Lok is likewise adapted to heavy-duty factory floors, garages, ramps, wharves, docks and similar structures. May we send you this new book? Send your name and address.

CARNEGIE STEEL COMPANY • PITTSBURGH

Subsidiary of United States Steel Corporation 279

US STEEL

I • BEAM • LOK *Armored*

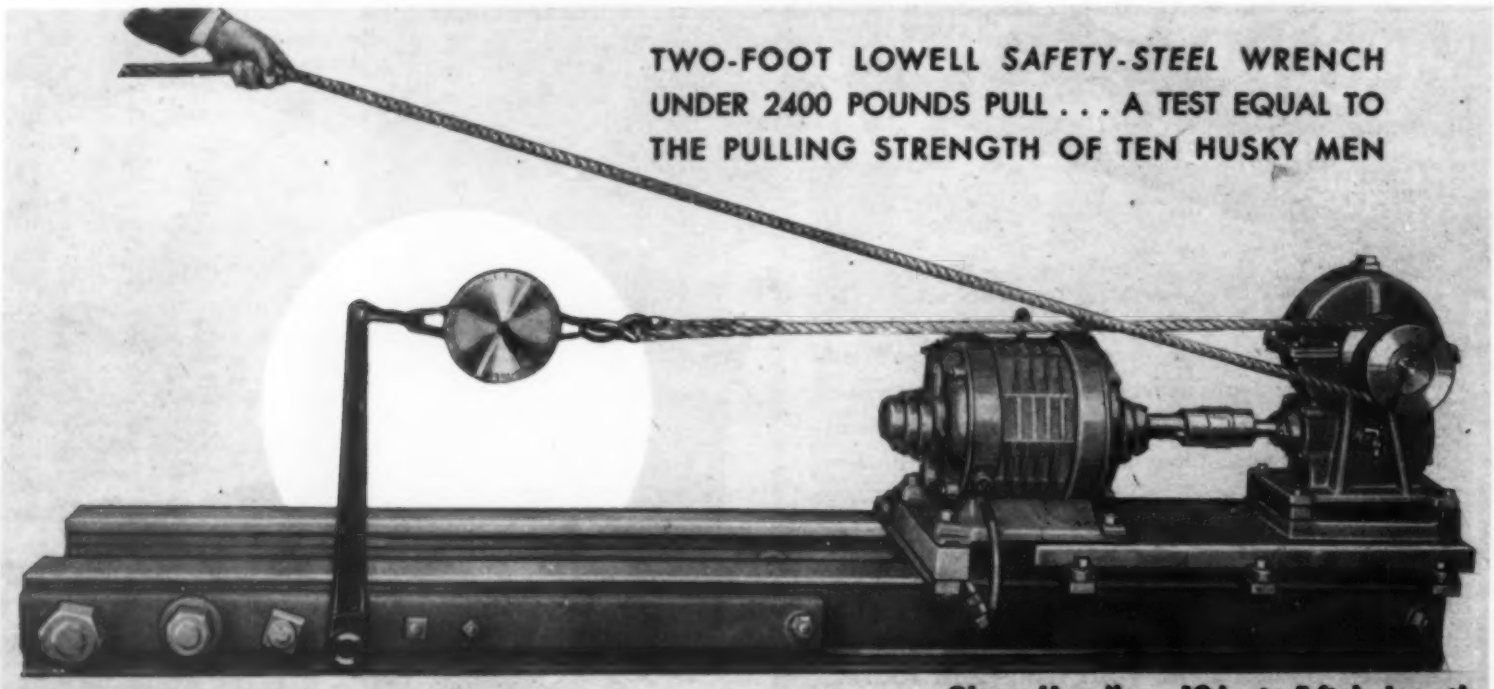
BRIDGE ROADWAY SLABS *and* HEAVY DUTY FLOORS

The Michigan Truck Shovel is a utility machine with many "plus" values—light and compact, travels under its own power, one engine furnishes power for rapid transportation and efficient digging, convertible to crane or dragline. Just the machine for many jobs too large to shovel by hand, yet too small to require a larger and less mobile shovel.

Let us send you details about this new machine. Write today!

MICHIGAN POWER SHOVEL CO.

BENTON HARBOR—MICHIGAN



TWO-FOOT LOWELL *SAFETY-STEEL* WRENCH UNDER 2400 POUNDS PULL . . . A TEST EQUAL TO THE PULLING STRENGTH OF TEN HUSKY MEN

We make actual tests in our plant.
No guess work as to what our Wrenches will stand.
Remember—A new handle for a broken one returned.

Sizes: Handles—10 in. to 5 ft. in length
Nut Sizes—½ in. to 9⅛ in. in diameter

Continuous Manufacturing for 70 years
Send for Catalog "R"

LOWELL WRENCH CO.

WORCESTER, MASS., U. S. A.

PUMP IT HOME WITH SAFETY WITH A LOWELL *SAFETY-STEEL* WRENCH

A Tower of Torture
for Wire Rope

ONE OF THE WORLD'S LARGEST PRECISION TESTING MACHINES

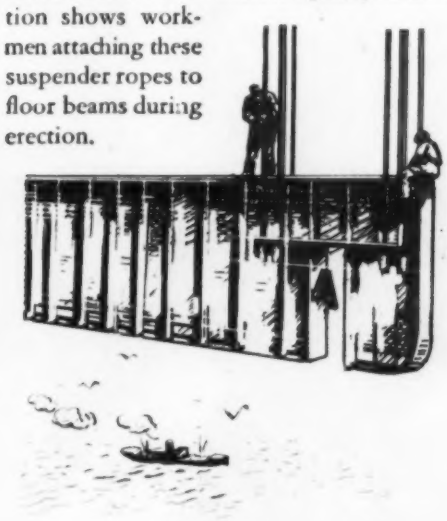
This giant testing machine has a capacity of 2½ million pounds, is 43 feet high, and weighs 138 tons. Routine specification tests of Roebling Rope are made on this and other Roebling testing machines which range in size down to 200 pounds capacity.

CAN PULL APART 6" SQUARE STEEL BAR

CAN CRUSH CAST IRON COLUMN 15' LONG, 15" DIAM., WITH 1¼" WALLS

CAPABLE OF TESTING LARGEST ROPES MADE

It was first used for tension testing the huge 2⅞ inch Roebling Suspender Ropes for the George Washington Memorial Bridge, between New York and New Jersey. Illustration shows workmen attaching these suspender ropes to floor beams during erection.



FOR YOUR PROTECTION: To make certain that Roebling Wire Rope will give the user the highest obtainable degree of safe, economical service, Roebling has left no stone unturned. It has enlisted the aid of the finest and most complete research, testing and manufacturing facilities. This testing machine is an example. John A. Roebling's Sons Company, Trenton, N.J. Branches in Principal Cities.

ROEBLING ...THE PACEMAKER IN WIRE ROPE DEVELOPMENT

A STRONGER AND BETTER WRENCH IN EVERY WAY

THE NEW MODEL

of the

FAVORITE reversible ratchet **WRENCH**

Just the tool for saving money on the nut-turning portion of the contract.

No lost motion with the "FAVORITE"

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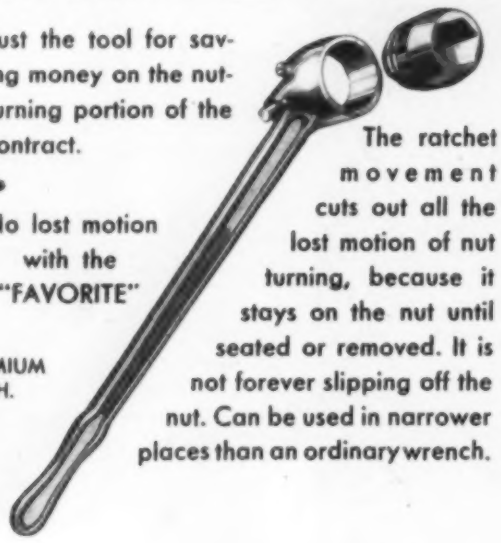
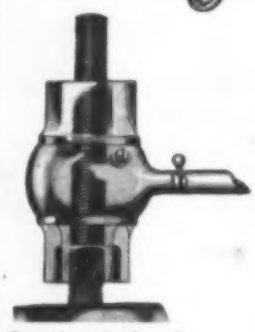


The ratchet movement cuts out all the lost motion of nut turning, because it stays on the nut until seated or removed. It is not forever slipping off the nut. Can be used in narrower places than an ordinary wrench.



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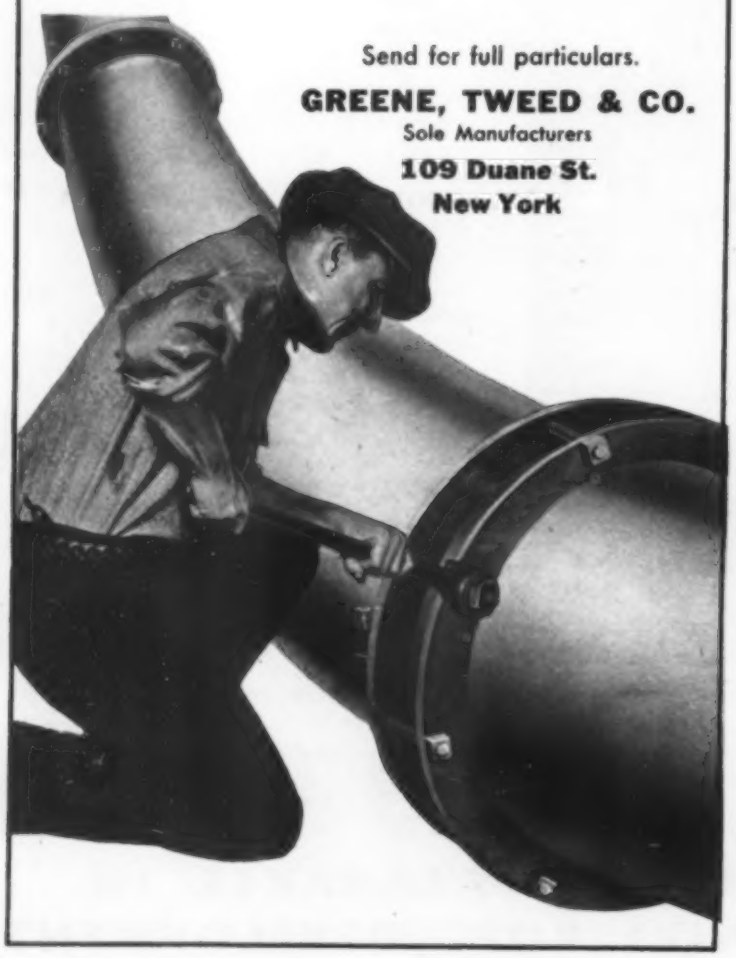

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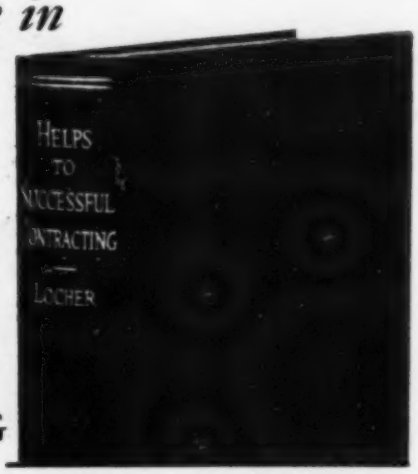

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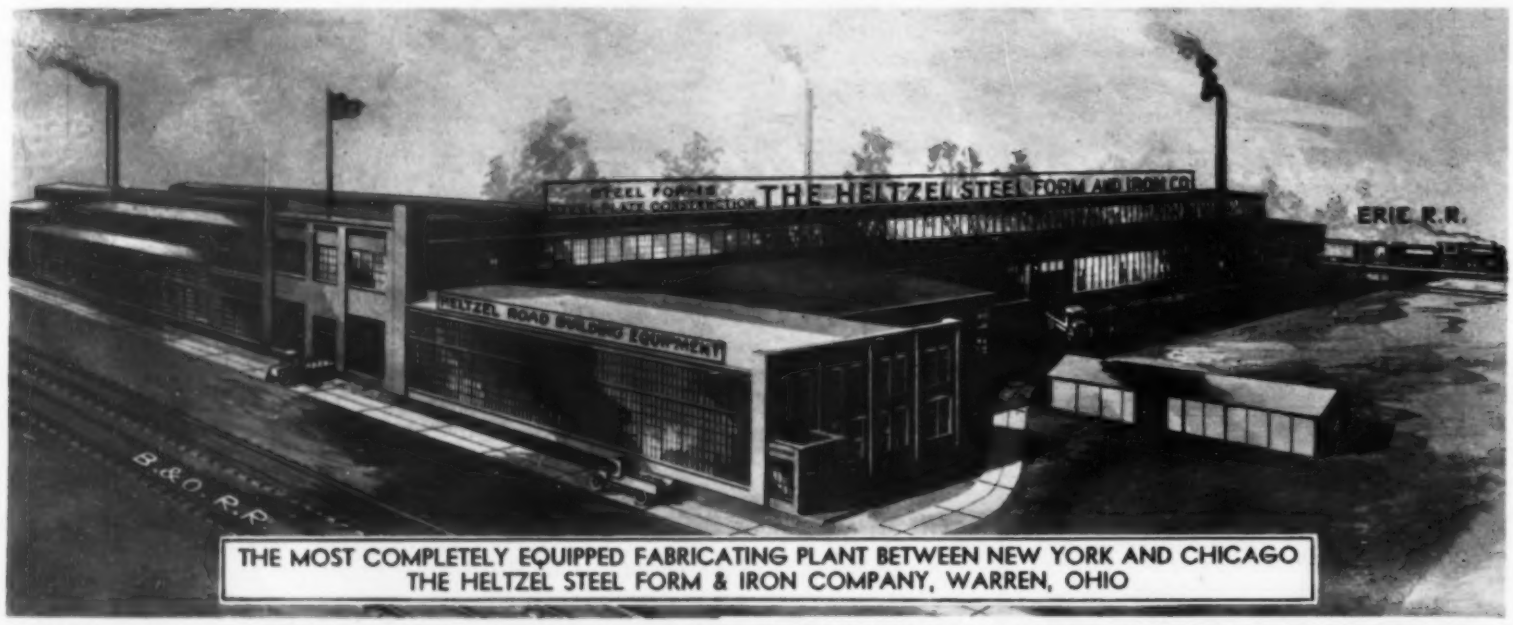

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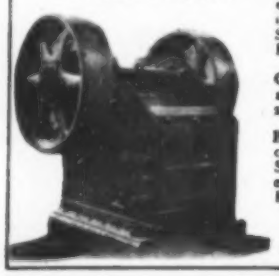

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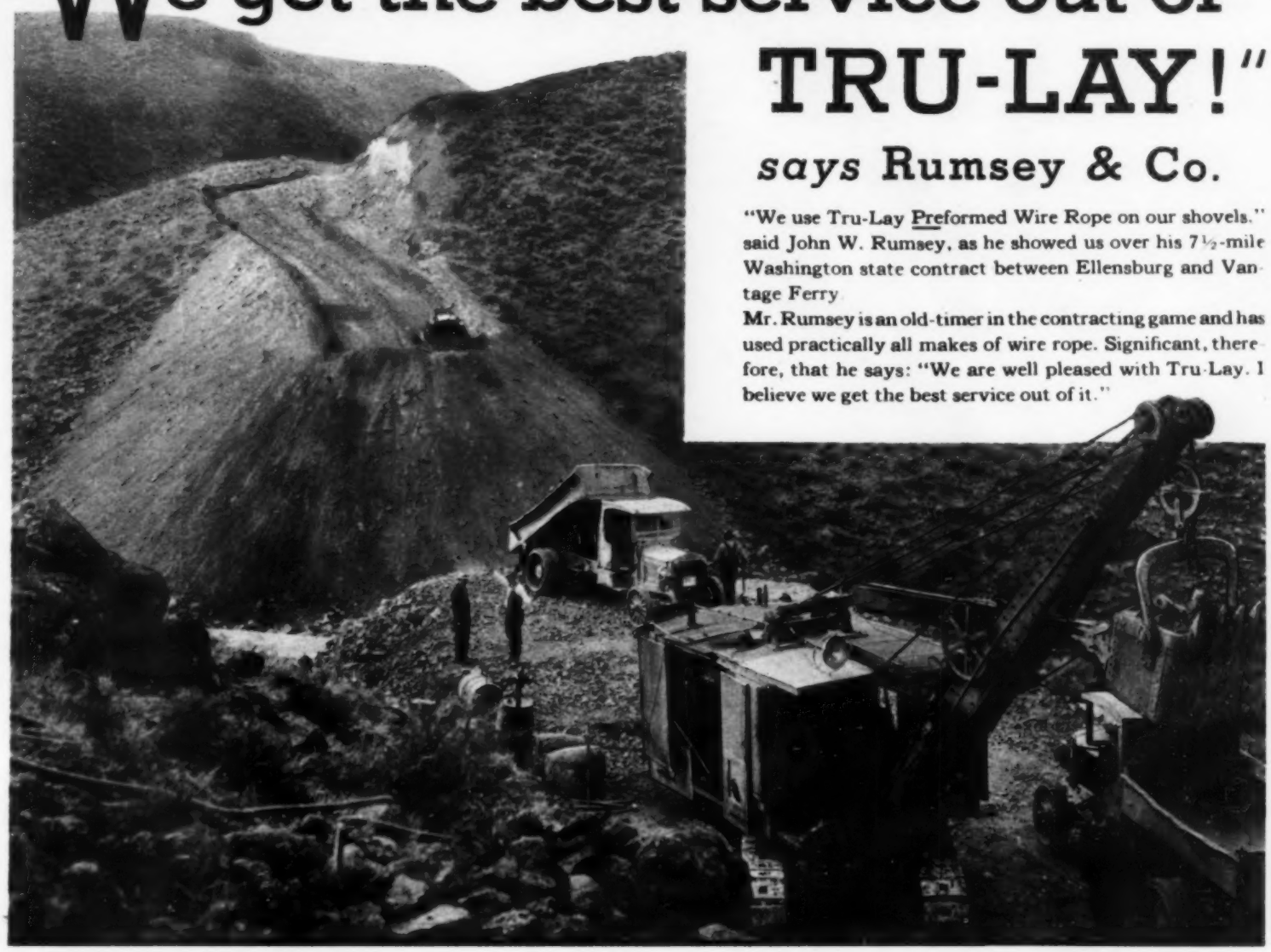

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